

# AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING  
ENGINEERING • PRODUCTION • MANAGEMENT

JULY 15, 1956

## In This Issue

- New Equipment Needed for Highway Program
- How Windshield Reveal Moldings Are Made
- Automatic Conveyors in Bendix Foundry
- Austin Plant Makes Own Transfer Machines
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- Plastic Jigs for Production of Aircraft

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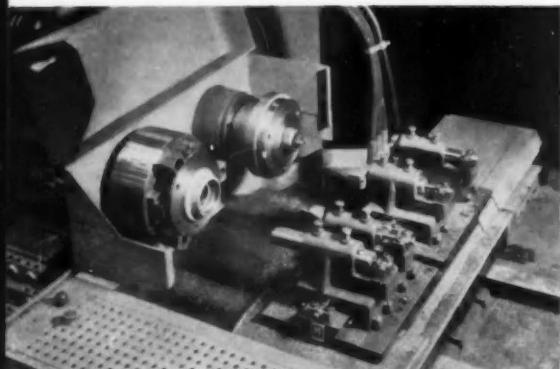
A CHILTON PUBLICATION

# The ability of Heald

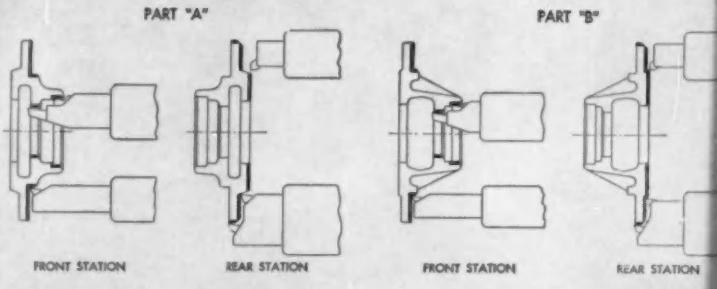
## **BORIZING\*** to

combine operations and  
reduce handling time can  
make other precision finishing  
methods obsolete, regardless  
of age of equipment

**FOR EXAMPLE:** This One Bore-Matic Replaced Two Older Machines  
and Increased Production more than 50%



This new Heald Model 321 Bore-Matic performs combined boring, turning and facing operations on both ends of two different differential bearing carriers, as shown in the diagrams above. The job was formerly done in sequential operations on two separate machines, at a net production of 105 parts per hour. Borizing on this single-machine setup increased production to 166 parts per hour, with closer tolerances, better finish and much easier operation.



*It PAYS to come to Heald*

\*Borizing is a copyrighted word meaning the application of any number or variety of precision finishing operations performed on a Heald Bore-Matic.



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Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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Truck powered by Waukesha WAKR (Butane).



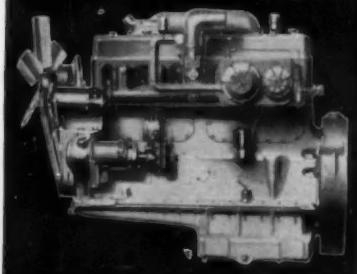
for  
**HEAVY**  
hauling

# WAUKESHA

1197 CUBIC INCH  
**Extra Heavy Duty ENGINES**

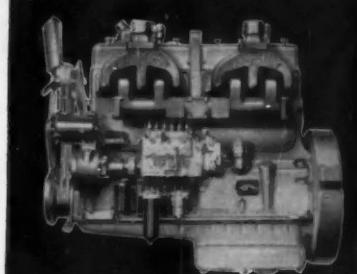
Up to 352 max. hp, all with counterbalanced crankshafts

WAKR BUTANE



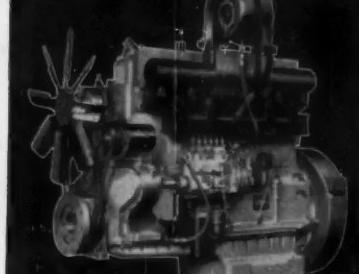
**WAKR Butane**—six cylinders, 6 1/4-in. bore x 6 1/2-in. stroke, 1197 cu. in. displacement, 290 hp at 1800 rpm.

WAKDB NORMAL DIESEL



**WAKDB Normal Diesel**—six cylinders, 6 1/4-in. bore x 6 1/2-in. stroke, 1197 cu. in. displacement, 258 hp at 1800 rpm.

WAKDBS TURBODIESEL



**WAKDBS Turbocharged Diesel**—six cylinders, 6 1/4-in. bore x 6 1/2-in. stroke, 1197 cu. in. displacement, 352 hp at 1800 rpm.

Write for descriptive bulletins

313



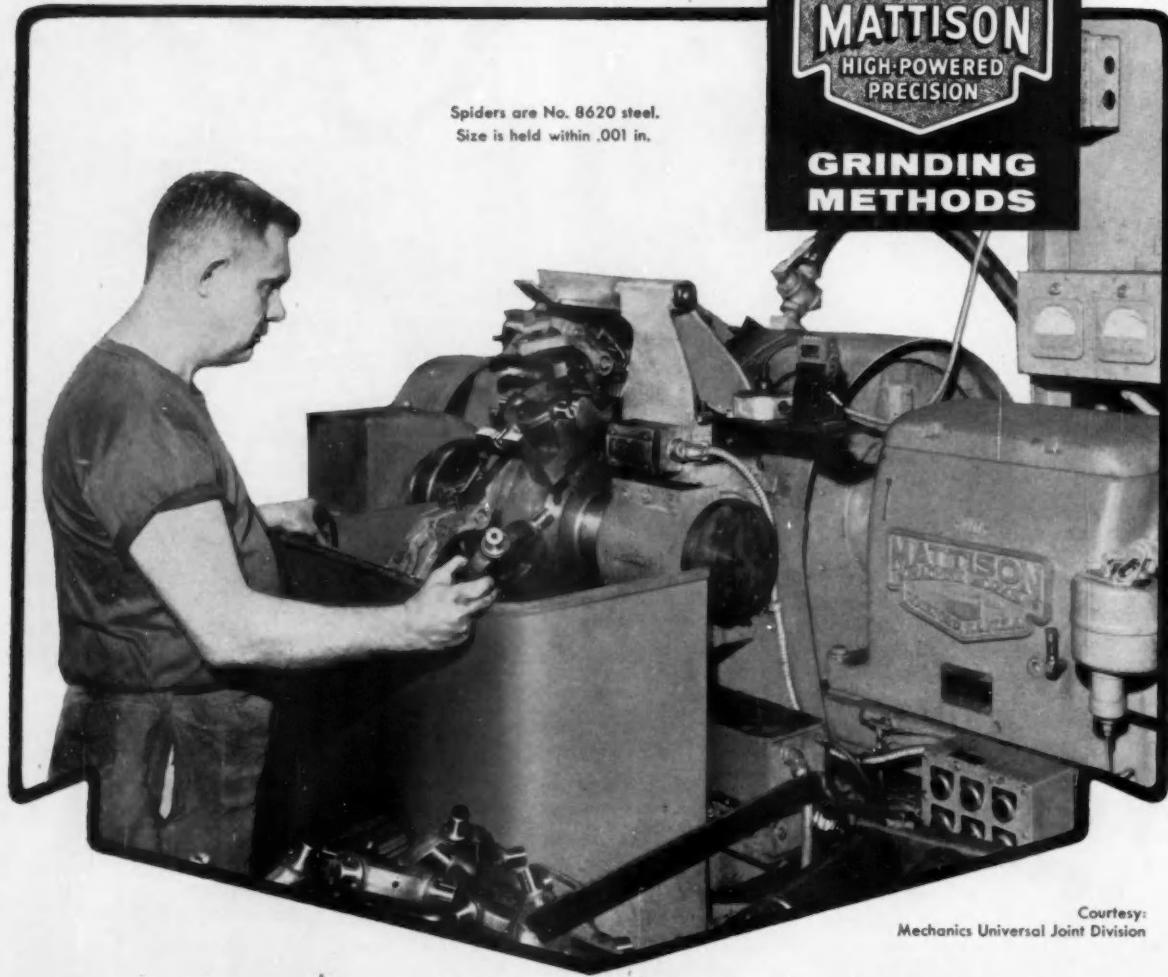
WAUKESHA MOTOR COMPANY • WAUKESHA, WIS.

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TULSA

LOS ANGELES

CASE HISTORY NO. 22—UNIVERSAL JOINT SPIDERS.



**Hold 4 ends square, parallel, and to size  
on high-production, double-disc grinder!**

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Parts are held in "V" fixtures with swiveling "U" blocks, and fed through the Mattison on a rotary-drum type feed mechanism, which is manually loaded and unloaded. This is one of

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HIGH-POWERED  
PRECISION  
SURFACE  
GRINDERS



# AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE PUBLISHED SEMI-MONTHLY

JULY 15, 1956

VOL. 115, NO. 2

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Audit Bureau of Circulations



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from C-B Tool Company**

**IT WEIGHS LESS,  
COSTS LESS,  
WORKS BETTER**

WITH  
**OSTUCO**  
**STEEL**  
**TUBING**



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- **Saves Weight-3 pounds on each unit!**
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*Perhaps this story  
from C-B Tool has a message for you.*

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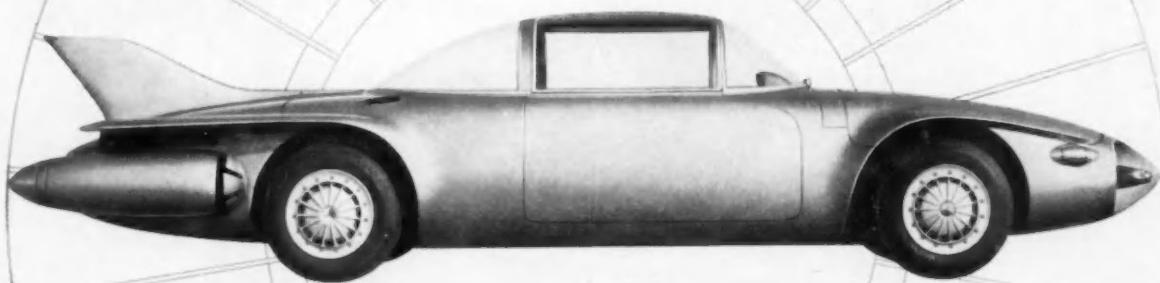
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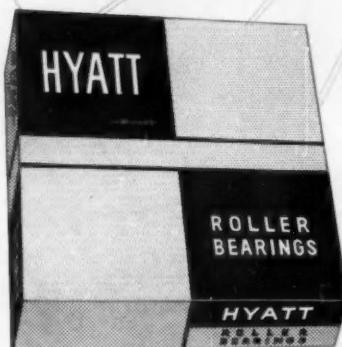
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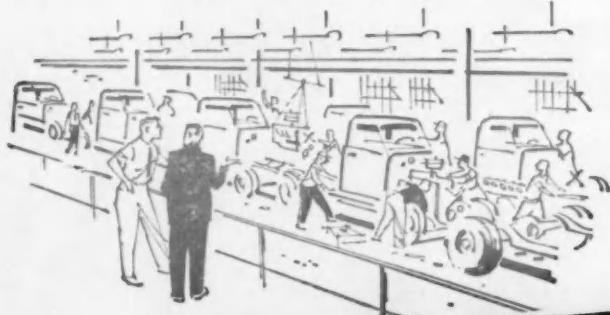
No ordinary bearings, however, could handle this job. So HYATT designed special roller bearings which operate efficiently and dependably in this punishing service. Just as dependably as do the millions of HYATT taper bearings which are used in *nearly half the automobiles being built today!*

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**if the  
FLEET OWNER  
built his own trucks—**



**ZENITH**  
CARBURETORS

They say it's a buyer's market. Well the truth is, for the truck operator, it's always been a buyer's market.

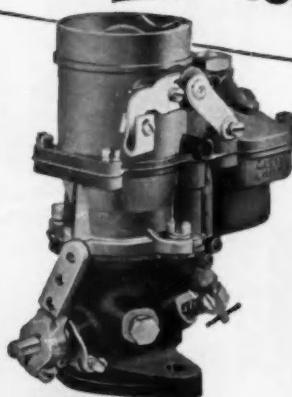
No American businessman sets more exacting standards than the fleet operator in his purchase of new equipment. There is good reason for this, for the operator's success or failure is to a very large degree determined by the efficiency of the vehicle he employs.

This yardstick of efficiency is likewise applied to every component part that contributes to truck performance.

That's why you can be certain if truck operators built their own trucks, Zenith\* would be the choice for standard equipment.

One more reason why—if you build, buy, sell or operate trucks, Zenith should be *your* choice for the best in carburetion.

would be his choice



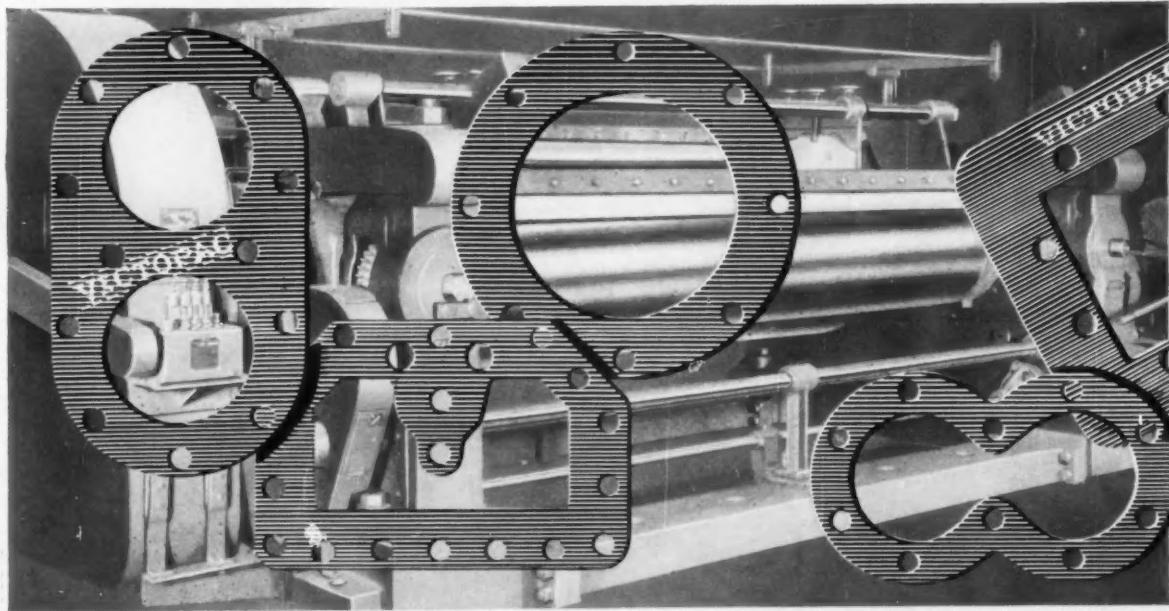
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**Bendix**  
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Victor Mfg. & Gasket Co., P.O. Box 1333, Chicago 90, Ill.  
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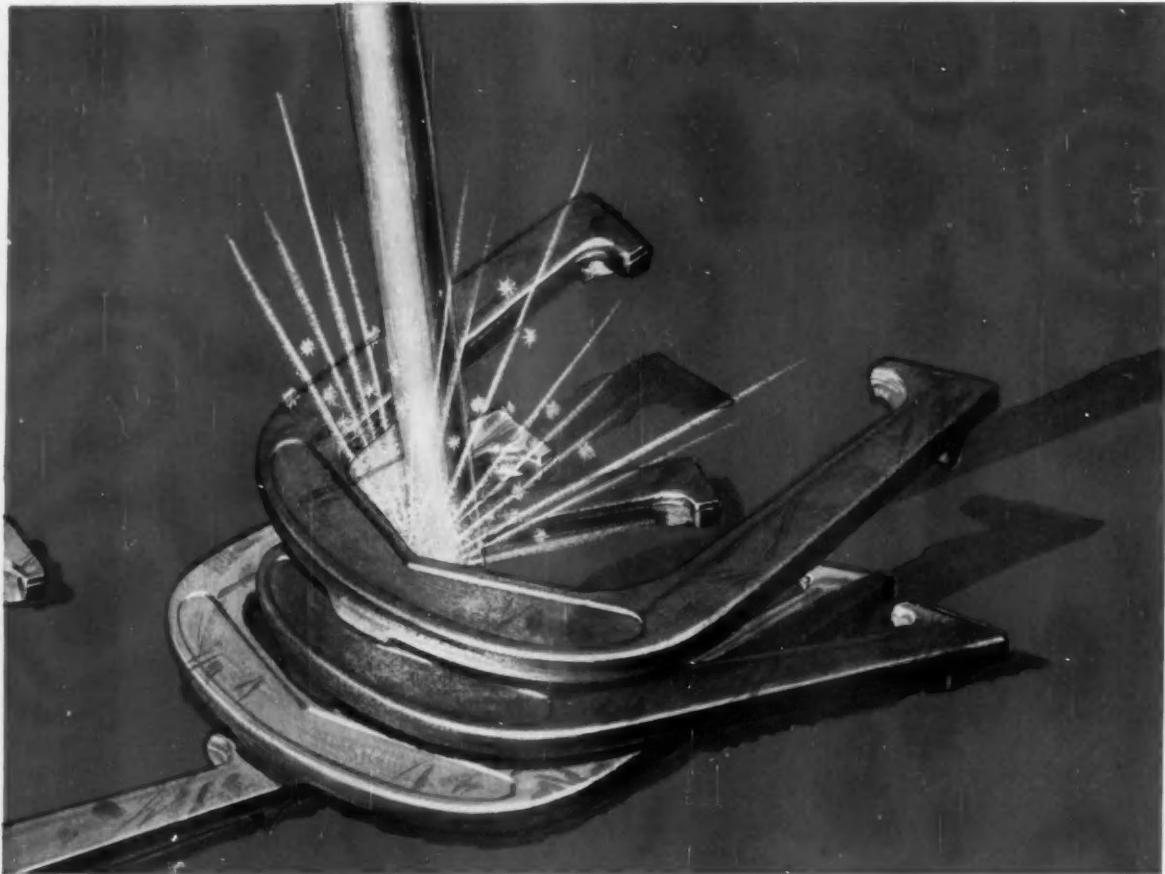
### VICTOPAC CONDENSED SPECIFICATIONS

Type	SAE-ASTM Spec.	% Compression 5000 p.s.i. Load	Recovery %	Minimum Original Tensile	Max. Thickness Change in ASTM Oil No. 1—5 hrs. at 300° F.
1	G-1111-1	12 ± 5	40	1800 p.s.i.	20%
1	G-1111-2	20 ± 5	40	1250 p.s.i.	20%
1B	G-1111-1	12 ± 5	40	1800 p.s.i.	20%
2	G-1111-1	12 ± 5	40	1800 p.s.i.	20%
Graphite coated, one side					
3	G-1111-1	12 ± 5	40	1800 p.s.i.	20%
Graphite coated, two sides					
50V	G-1122-1	12 ± 5	40	2000 p.s.i.	10%
60V	G-1123-1	12 ± 5	40	2000 p.s.i.	15%

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**"Finish first in your league"**

**...with J&L COLD FINISHED JALCASE STEELS**

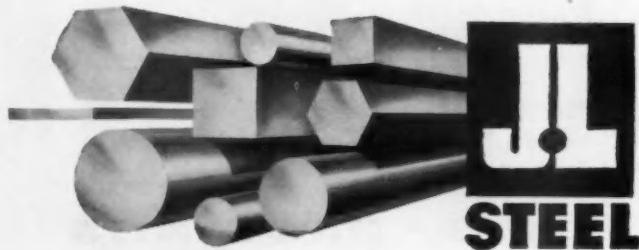
Cold Finished Jalcase—now available in 10 SAE and AISI grades—is the original free-cutting open hearth steel having the mechanical properties required for special service machined parts. And it's especially suitable for heat treating. This grade is one of a complete line of premium quality, free-machining bar steels developed over the years by J&L specialists. Thus, we can recommend the right type to help solve your particular problems.

Fundamental advantages of Jalcase are:

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- Minimum distortion
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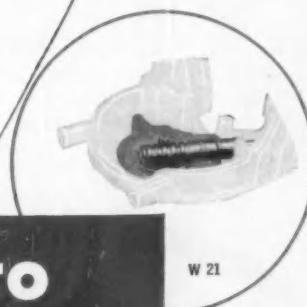
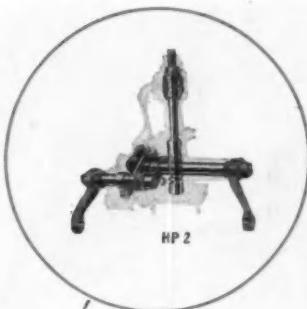
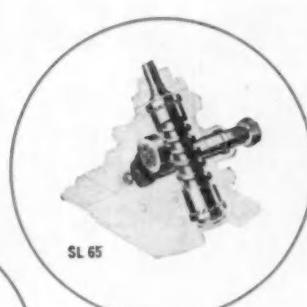
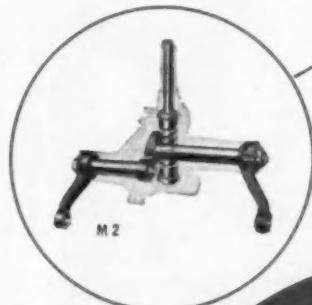
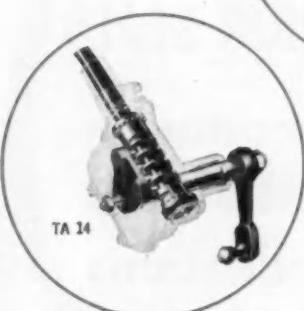
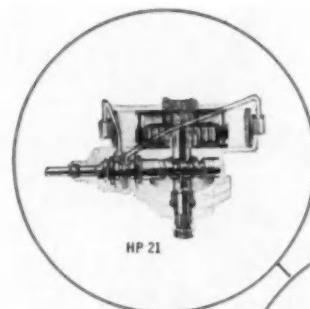
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\*What Ross has done for the farm industry  
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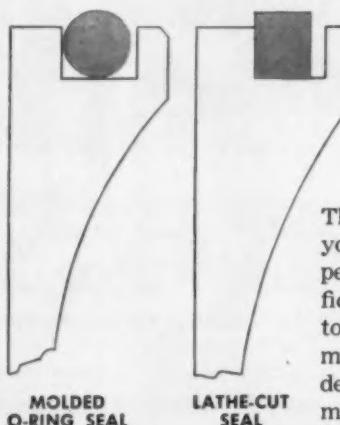
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**STEERING**

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seal applications



This seal will save you money with no performance sacrifice. Minimum tooling cost, no molds, no costly delays. Can be made up to 25" I.D.

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## WHY SUNOCO WAY LUBRICANT CAN HELP CURE YOUR MACHINING PROBLEMS



**3. Protects expensive ways.** Badly scored or pitted ways, caused by inadequate way lubrication, result in lost production and expensive repairs. The high film strength of Sunoco Way Lubricant eliminates the danger of metal-to-metal contact, the chief cause of scoring and way wear. Excellent metal-wetting and non-corrosive properties eliminate rusting and pitting.



**4. Approved by more than 55 machine-tool builders.** Every major machine-tool builder has tested Sunoco Way Lubricant. It is always approved. In fact, to assure maximum efficiency of their product, many manufacturers ship a supply of Sunoco Way Lubricant with each machine. We'll be glad to send you the list of manufacturers who have approved Sunoco Way Lubricant.

For more information, see your Sun Representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AA-7.

INDUSTRIAL PRODUCTS DEPARTMENT  
**SUN OIL COMPANY**  
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AUTOMOTIVE INDUSTRIES, July 15, 1956





## How UNIONMELT Welding Makes Tough Parts Tougher . . . Faster

UNIONMELT welding produces deep penetrating welds at top speeds, and is improving the production and quality of many parts used in rugged earth-moving equipment.

A 24 in. porosity-free circumferential seam, made by UNIONMELT welding in 62 sec., has eliminated oil leakage in sealed track rollers. Welds are made in 85 in. long track roller frames in only 5 minutes.

Another UNIONMELT welding setup used in the production of tractor wheels, makes two top-quality welds in one operation . . . A weld is made in a wheel hub at the same time the hub is welded to a 27 in. diameter rim.

UNIONMELT welding is particularly efficient in the fabrication of heavy materials because it—

- **Joins metal of any thickness**—in multiple passes. Metals up to 3 in. thick can be joined in one pass.
- **Means greater economy**—uses large diameter, low cost wire.
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Start saving now with UNIONMELT welding . . . Call your local LINDE representative for more information, and ask for a copy of Form 7942-A, "Modern Methods of Joining Metals."



UNIONMELT welding completes a contour weld in a bulldozer C-frame in an average speed of 17 in. per minute.



UNIONMELT welding eliminates leakage. A 24 in. circumference weld made in 62 sec. seals these grease-filled track rollers.

**Linde Air Products Company**  
A Division of Union Carbide and Carbon Corporation

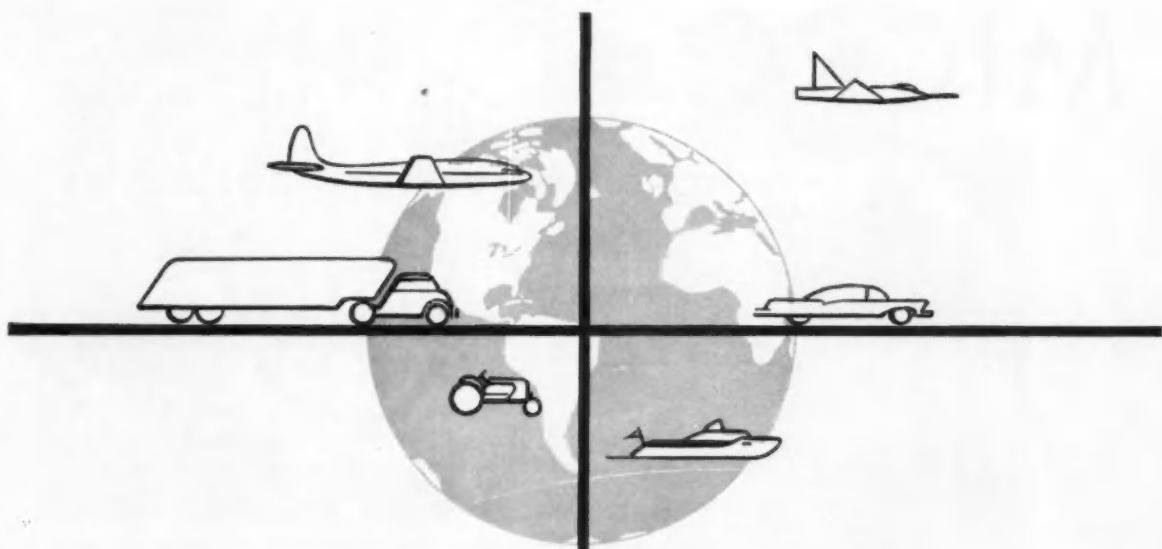
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In Canada: LINDE AIR PRODUCTS COMPANY  
Division of Union Carbide Canada Limited, Toronto  
(formerly Dominion Oxygen Company)

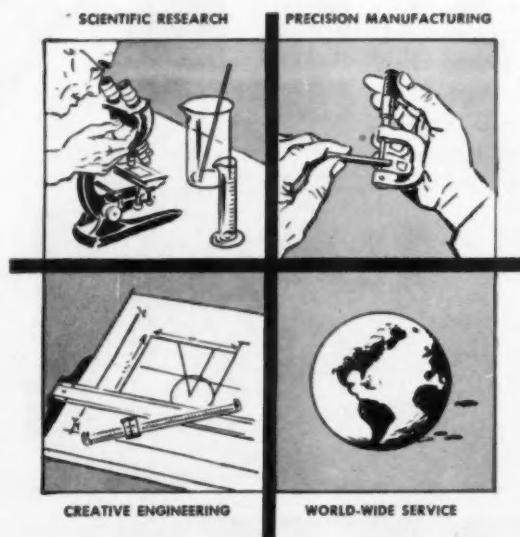
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**Linde**  
Trade-Mark



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**THE ELECTRIC AUTO-LITE COMPANY**  
TOLEDO 1, OHIO



# MICROHONING\*

with self-dressing abrasives  
generates consistent  
**Functional Surface Finishes**

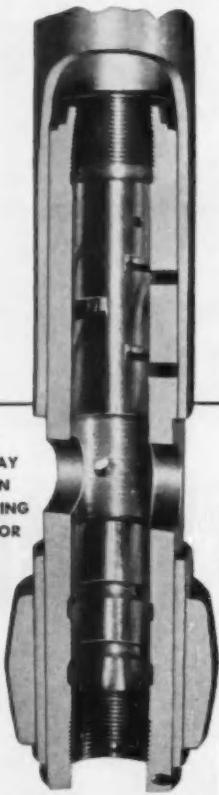
Microhoning, the low-velocity abrading process consistently produces part after part exactly to your specified surface finish requirements, because the abrasive grits always remain sharp.

**SELF DRESSING ACTION OF THE ABRASIVES . . .** is accomplished by the rotation and reciprocation of the Microhoning tool—the combined motion continuously changes the direction of force on the abrasive grits and keeps them dressed.

**EFFICIENT STOCK REMOVAL . . .** results from the many sharp-cutting grits acting simultaneously over a wide area of work surface. In this manner, the effect of heat is also minimized. Of all production processes, Microhoning least disturbs the sub-surface structure of the work.

**FUNCTIONAL SURFACE CHARACTERISTICS . . .** are obtained in one uninterrupted cycle. Microhoning generates accuracy within millionths of an inch . . . surfaces free of waviness, taper, out-of-roundness and structural stresses . . . uniform surface finish and a cross-hatch pattern for best lubrication, sealing and wear characteristics.

CUTAWAY  
SECTION  
OF STEERING  
ACTUATOR



Monroe Auto Equipment Co. designed its power steering unit to withstand rugged use while maintaining sensitive control. In the final processing of the hydraulic steering actuator, Monroe chose Microhoning to obtain diametric accuracy, consistent finish and to generate geometric precision.

The rough and finish Microhoning operations removed .005" stock from an interrupted bore 1.125" in diameter and 6 3/8" long.

**MATERIAL AND HARDNESS:** SAE 1118 steel, Rockwell 45-50C

**TOLERANCES:** size—.0003"  
roundness and taper—.0001"

**FINISH:** 25 microinches or less

**CYCLE:** rough Microhoning—35 to 40 seconds  
finish Microhoning—15 to 20 seconds

**MACHINE:** Double-column Model 740 Hydrohoner



For more details on this application write for CROSS-HATCH Vol. 8, No. 1

\*MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

## MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

# Here's how C/R COOPERATIVE RESEARCH *can help you*

**HELP YOU ENGINEER YOUR PRODUCT,  
ELIMINATE TOUGH TROUBLE SPOTS  
AND SAVE YOU MONEY IN FLUID  
SEALING AND RELATED FIELDS**

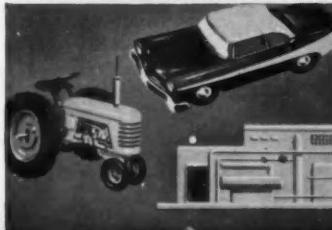
Developing a new product or rectifying trouble in a present one? Why not supplement your own engineering facilities with C/R Cooperative Research? In the areas related to oil seal design, lubricant, chemical, gas, or air retention, and foreign matter exclusion—as well as in the development of synthetic rubber and impregnated mechanical leather parts—Chicago Rawhide's developmental facilities are the most extensive in the country.

All of them are at your service . . . for help with your critical or unusual problems. You may be sure that your design specifications, performance requirements, and production controls will be met to the letter. A few of the many ways in which C/R Cooperative Research serves other leading manufacturers are pointed out on this page. We'll be glad to help you.

**INFORMATION . . .** Comprehensive brochures and catalogs are available to give you the complete scope of C/R products and services. Write for your copies, and please indicate your area of interest.



## CHICAGO RAWHIDE



**DESIGN . . .** When your product is on the drawing board is the time to correlate design and materials with performance requirements. C/R's expertly-staffed engineering groups working in close cooperation with the material labs have done it for others . . . and can do it for you.

**MATERIALS . . .** Pioneers in the development of Sirvis (mechanical leather) and Sirvene (synthetic rubber) parts for oil seals and other mechanical applications, C/R will custom-develop materials for your special needs in our synthetic rubber or leather laboratories.

**PRODUCT TESTING . . .** Many products, new and present, need extensive checking. C/R testing labs often work many months to verify designs, eliminate trouble. This is standard procedure on all C/R stock products . . . essential in developing yours.

**TROUBLE SHOOTING . . .** Auto and heavy equipment makers, as well as manufacturers in most fields you can think of, have solved difficult sealing and related problems with the help of C/R Cooperative Research. You can, too . . . and save time, trouble and money.

**PRODUCTION . . .** Six plants, operating as extensions of C/R Cooperative Research, provide laboratory-like quality control, timed to your needs. C/R Sales Engineering follows through to coordinate and assure satisfaction.

**EXPERIENCE . . .** Broadest in the field. Proof? More automobiles, farm equipment and industrial machines rely on C/R Oil Seals than on any similar sealing device. C/R diaphragms, boots and gaskets are in the same top categories.

### CHICAGO RAWHIDE MANUFACTURING COMPANY

1100 Ogden Avenue, Chicago 22, Illinois

U.S. Patent & Trademark Office

© Canadian Seal Oil Seal Mfg. Co., Ltd., Montreal, Ontario

Export Sales: Scott International Corp., Great Neck, New York

C/R Products

C. R. Shaft & Seal Face Seals • Sealed Hydraulic rammed rubber plates

• Metal-Covered Insulated Rubber Cords, gaskets, liners • C.R. Seal Variable Speed



Winner of the Alfred P. Sloan  
Highway Safety Award

*Photo by Sarra Inc.*

I am a typewriter. Across my ink-stained face are written many human experiences. During the coming beautiful days, I shall pound into the record books many names.

I SHALL WRITE—Killed, passing on a hill, John Doe.—Killed, passing on a curve, Bill Doe, wife and 3 children.

I SHALL ALSO WRITE—"To save a minute, he lost a life" or "A minute saved—a quick trip to the grave."

Tired, hackneyed phrases describing the end of bubbling, enthusiastic, happy lives. I write on...pounding names into the record books of death.

What's YOUR name? What's YOUR WIFE'S name? How many CHILDREN have you?

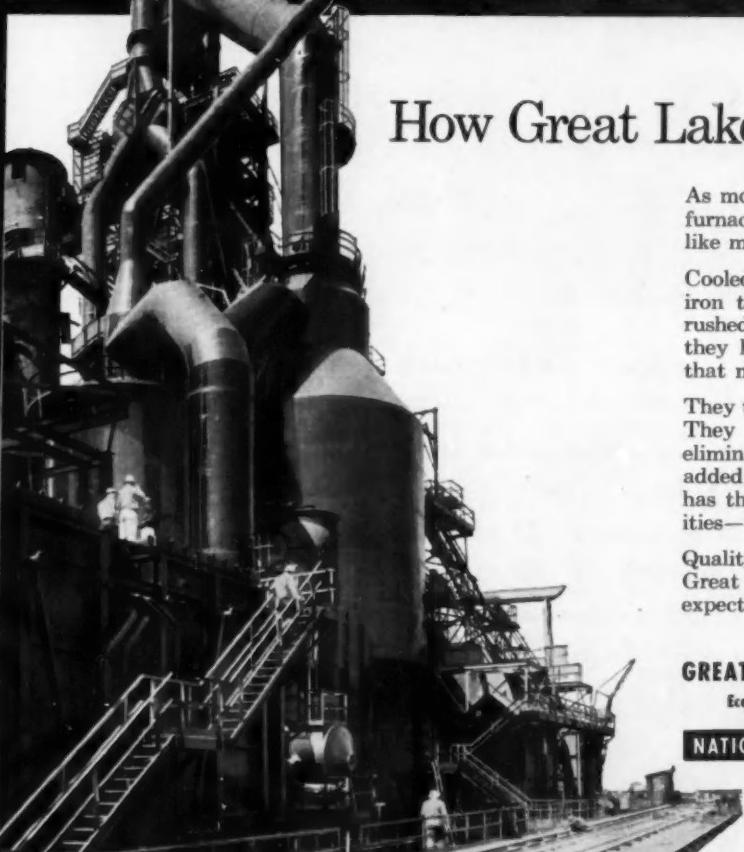
Because so many answer, I must write—I must work. YOU can make every day safer for yourself and your family by driving EXTRA carefully. Please be courteous, be careful—I CAN SPELL ANY NAME.

Automobile manufacturers and automotive suppliers are continually improving cars to help reduce the accident-causing tensions of driving. One of these suppliers, Auto Specialties Mfg. Co., Inc. of Saint Joseph, Michigan, has developed safer brakes for today's more powerful cars: Auto Specialties Double-Disc Brakes. These brakes, designed on an entirely new principle, have passed severe braking tests at leading car factories. Auto Specialties Double-Disc Brakes make driving safer, make drivers surer of their brakes. Their adoption by the car factories will be in keeping with the automotive industries' aim for safer and safer driving. So while you're out driving, be courteous, be careful. Remember, "I CAN SPELL ANY NAME."

A 16-page, 4-color book, "The Stopping Story," gives detailed information about these brakes. It's free. Write for it to

## AUTO SPECIALTIES MFG. CO., INC. Saint Joseph, Michigan

Plants also at Benton Harbor and Hartford, Michigan and Windsor, Ontario, Canada  
Manufacturing for the automotive and farm machinery industries since 1908



## How Great Lakes Steel *molds* quality

As molten pig iron gushes from the world's largest blast furnace, a generous cupful is ladled out into small, trough-like molds.

Cooled and solidified, these "guinea pigs" (samples of the iron that goes into open-hearth steelmaking) are then rushed to Great Lakes quality control laboratories. For they hold a big chunk of the secret to producing steel that meets customer specifications *all down the line!*

They tell if the blast furnace burden is precisely balanced. They tell if as many impurities as possible have been eliminated. They help tell just what "seasoning" must be added to the open hearth charge, so every batch of steel has the desired chemical composition and drawing qualities—and no buts about it!

Quality control *every step of the way!* That's our job at Great Lakes Steel . . . that, and the kind of service you expect—and get—from just one phone call.

### GREAT LAKES STEEL CORPORATION

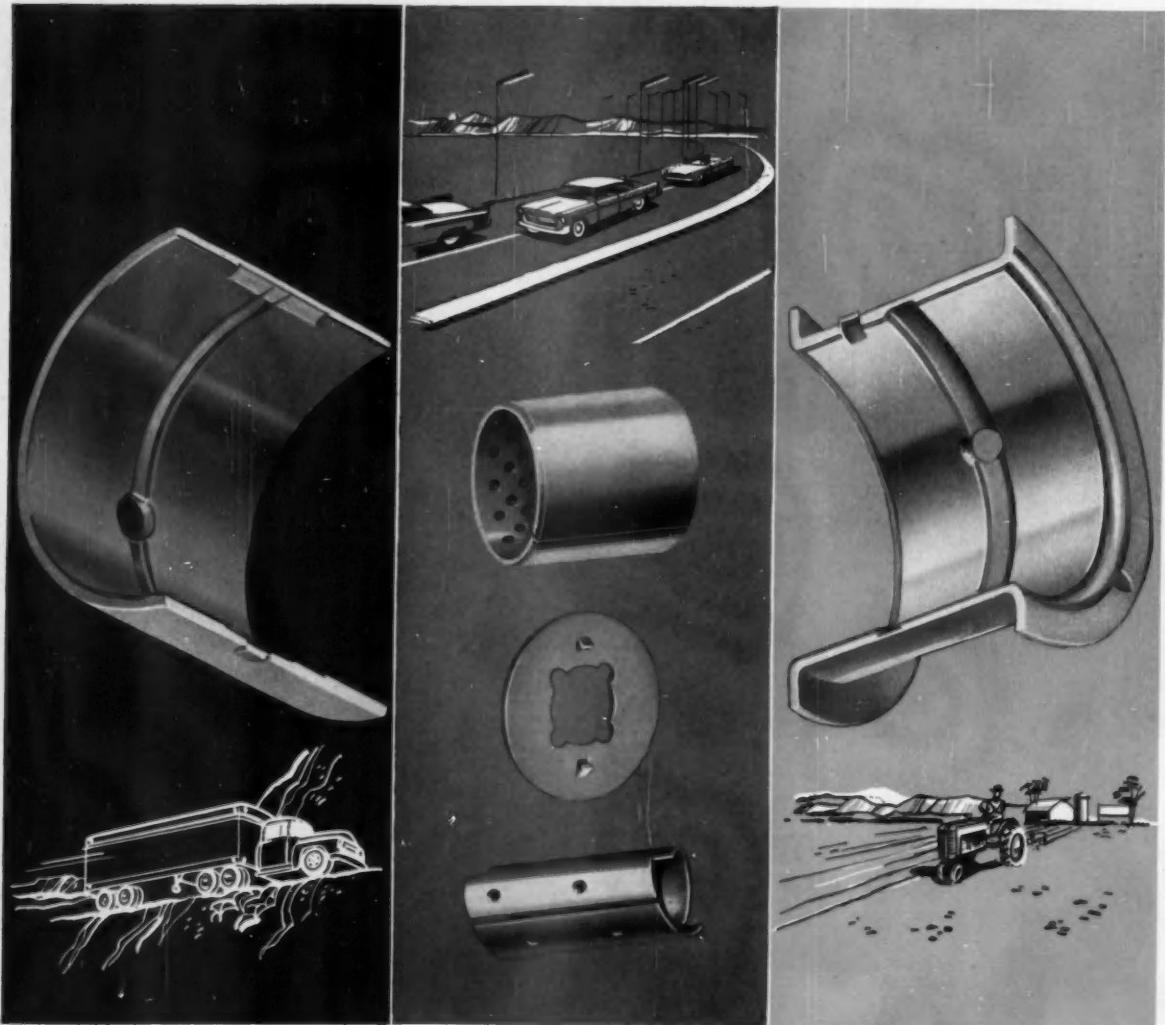
Ecorse, Detroit 29, Mich. • A Unit of

NATIONAL STEEL CORPORATION



LARGEST IN THE WORLD and first with a hearth diameter of over 30 feet, the No. 1 Blast Furnace is one of four at Great Lakes. Thanks to constant control, these furnaces produce iron that, beyond question, spells higher quality steel.

District Sales Offices: Boston, Chicago, Cincinnati, Cleveland, Grand Rapids, Houston, Indianapolis, Lansing, Los Angeles, New York City, Philadelphia, Pittsburgh, Rochester, St. Louis, San Francisco, Toledo, Toronto.



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Our 56 years of specialized experience is part of every one of the millions of sleeve bearings we produce each year. It means that each of these bearings will meet the most exacting requirements of practically every type of automotive, industrial and agricultural equipment. We maintain complete facilities for research and engineering, and quality control in all of our plants.

## FEDERAL-MOGUL DIVISION



FEDERAL-MOGUL-BOWER BEARINGS, INC., 11037 SHOEMAKER, DETROIT 13, MICHIGAN



## ACTION PICTURE of how to save money by riveting!

This action photo, taken on the frame assembly line in one of the largest auto factories, illustrates how cost-conscious manufacturers save money with Hannifin "Hy-Power" Hydraulic Riveters.

First step in assembly is to rivet the frame together...with Hannifin "Hy-Power" Riveters. The light-weight forged C-Frames hang from balancers within easy reach of each operator. No special skill is required to head the  $\frac{3}{8}$ " rivets, cold, each in seconds. What's more, this "silent squeeze" method forms stronger, more uniform rivets, hot or cold.

Power source is the Hannifin "Hy-Power" Hydraulic Pressure Generator which quietly supplies pressure to the "Hy-Power" Cylinder that does the work. These riveters are available in  $7\frac{1}{2}$ , 10,  $12\frac{1}{2}$ ,  $17\frac{1}{2}$ , 25, 35, 50, 75 and 100-ton capacities.

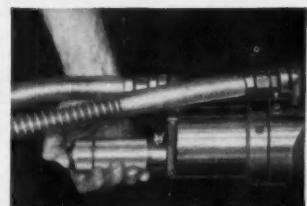
do ALL you can do...with

# HANNIFIN

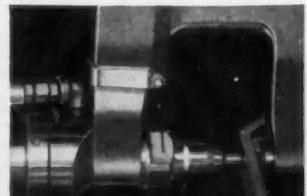
Hannifin Corporation, 543 S. Wolf Rd., Des Plaines, Ill.

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

here's the  
**HANNIFIN**  
**"HY-POWER"**  
**WORK CYCLE**



In position. A single control button starts (or interrupts) the automatic Hy-Power cycle.



Ram approaches fast, then hydraulic pressure automatically intensifies, and the rivet head is formed.



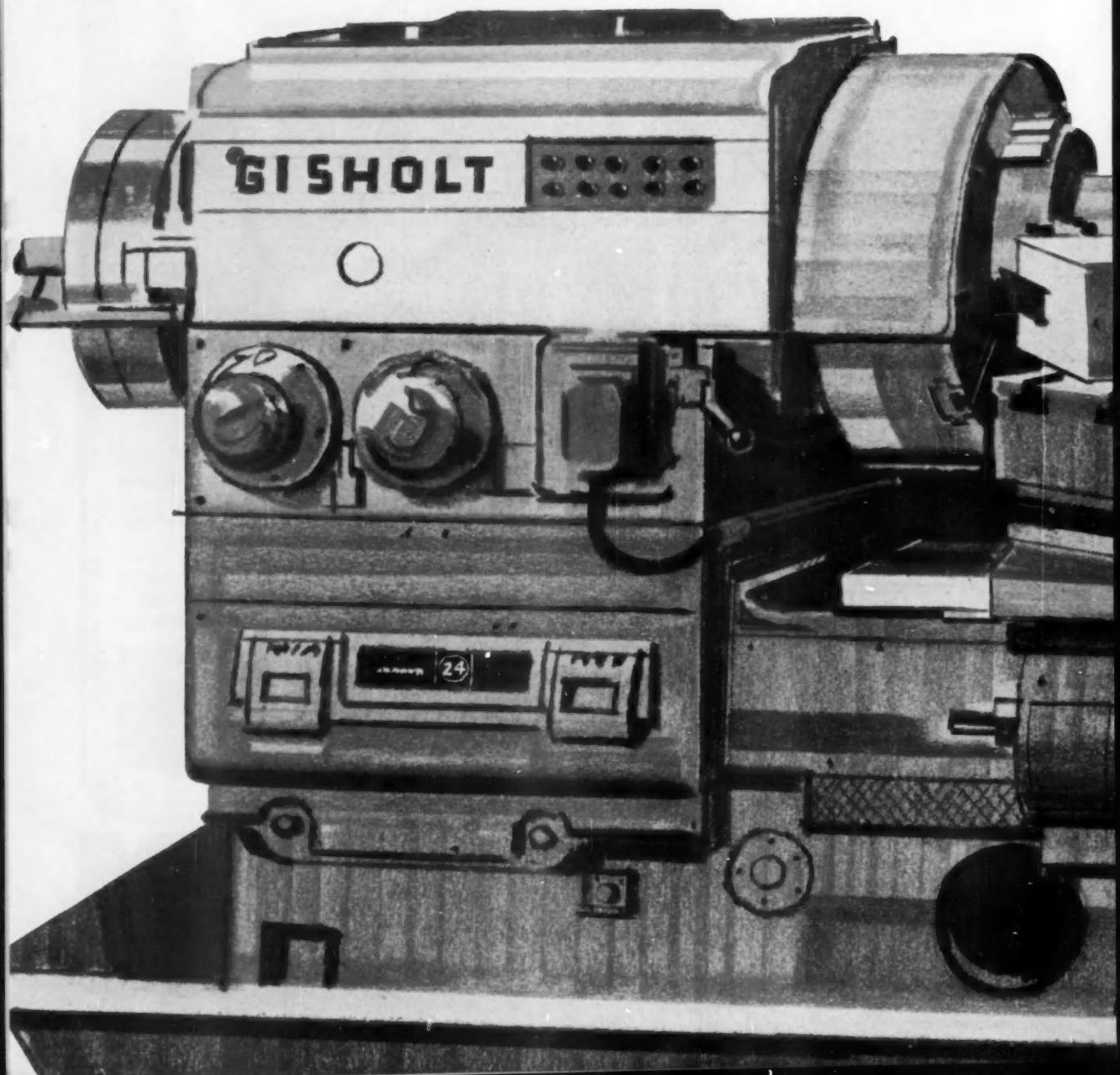
Fast, automatic return. Total elapsed time to head a rivet is only 2 to 3 seconds.

### "HY-POWER" CAN ALSO BE USED IN MULTIPLE TO SET SEVERAL RIVETS

Bulletin 150 tells  
how to save  
money on riveling,  
staking,  
punching,  
forming  
and bending  
operations. Write  
for copy.



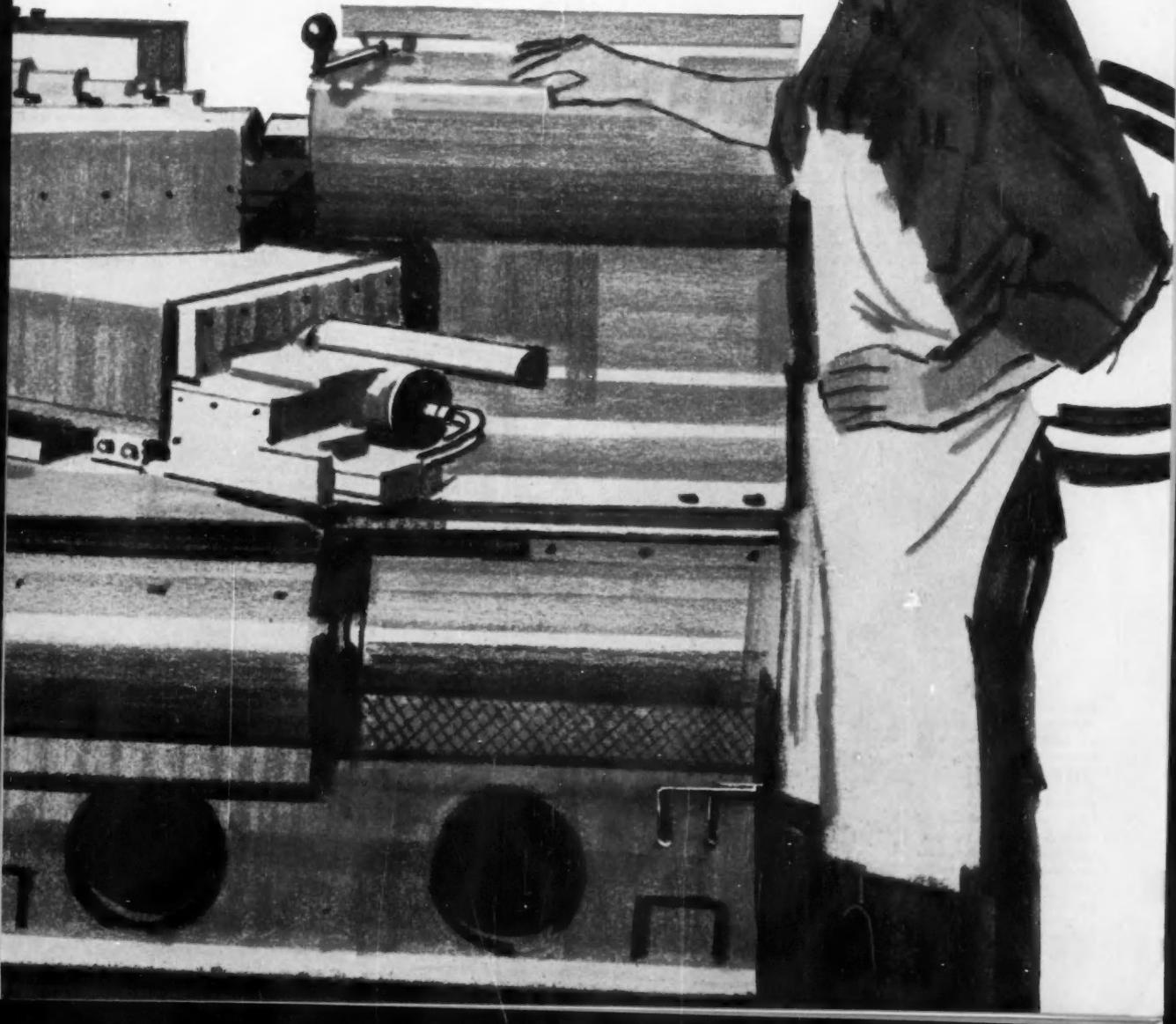
GISHOLT MASTERLINE  
NO. 24 AUTOMATIC  
PRODUCTION LATHE





In this Gisholt MASTERLINE No. 24 Automatic Production Lathe, there are many important design refinements to provide faster operation, improved quality, quicker setup and lower maintenance. This machine offers the great power, versatility and simplicity you are looking for to reduce costs on large parts with new minimum requirements for operator skill, attention and effort. Now is the time to let us tell you how it can be profitably applied to your manufacturing processes.

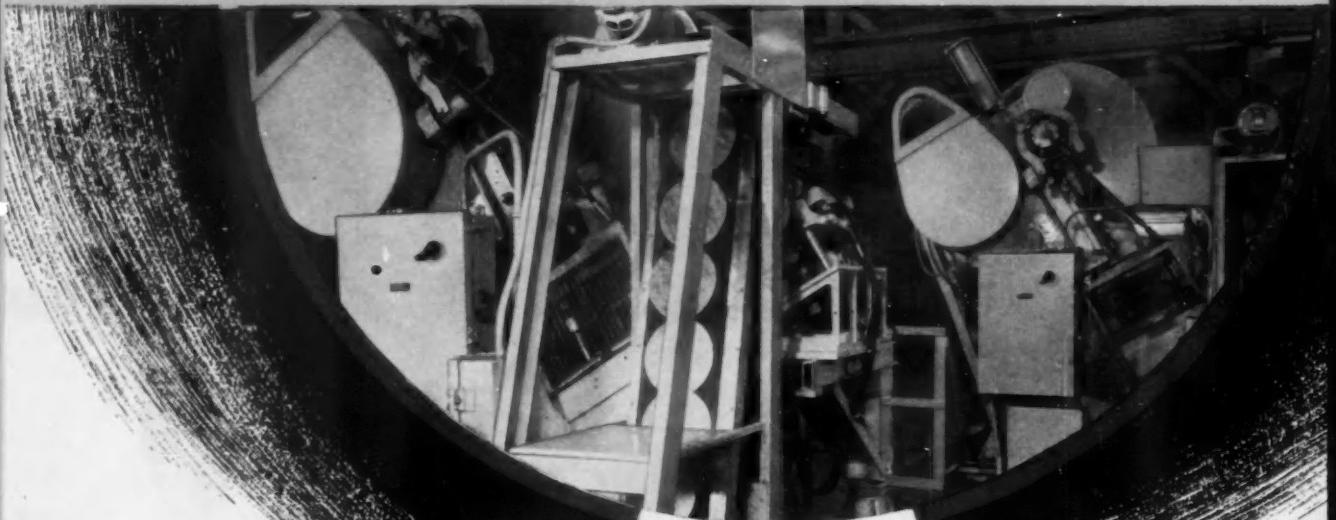
Gisholt Machine Company, Madison 10, Wisconsin  
*Look ahead—keep ahead—with Gisholt*



**keyhole view of key operations in . . .**

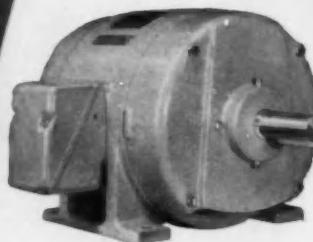


## **4 NIAGARA AUTOMATIC OBI's PUNCH OUT**



**(Upper)**  
Two Niagara OBI's operate on each of the two G-E automated production lines at Building 85.

**(Lower)**  
Fully automatic, 4 Niagara OBI's are fed by magnetized conveyor belts. Stator punchings leave press on upper conveyor and rotor punchings on lower, at rear of press. Scrap is discharged to under-floor conveyors.



Tri-Clad® '55' Motors such as this are manufactured in Building 85.

# GENERAL ELECTRIC'S "SUPER SECRET" BLDG. 85 WHICH CUT MOTOR PRODUCTION TIME FROM 2 WKS. TO 24 HRS.

Strictly "hush-hush" for its first year and a half of operation, General Electric's now widely publicized Building 85 in Schenectady gives the rest of the metalworking industry plenty of food for thought.

Chopping down production time of 7½ - 30 hp induction motors, from 2 weeks to 24 hours, is no mean feat. G.E.'s medium induction motor department has done it with the very latest ideas in mechanized fabrication.

Helping to perform the important job of punching out lamination blanks for stators and rotors are 4 fully automatic Niagara OBI Presses. Each is equipped with General Electric ACA adjustable speed drives for maintaining flexibility in the flow of parts to meet market demands for 100 standard motor models . . . the very feature that Building 85 is famous for: *Variety and Automation, too!*

Fitting perfectly into the scheme of things at this, the most modern of electric motor plants, Niagara OBI's operate on fully automatic cycles. Automatically fed by magnetized conveyor belts, they likewise discharge their work automatically to the next operation. Metal waste is removed by under-floor conveyors.

Tough assignment for an OBI? Not for a Niagara! On last report, G.E. was getting 100,000 punchings per press from each set of dies

## ROTOR AND STATOR LAMINATION BLANKS

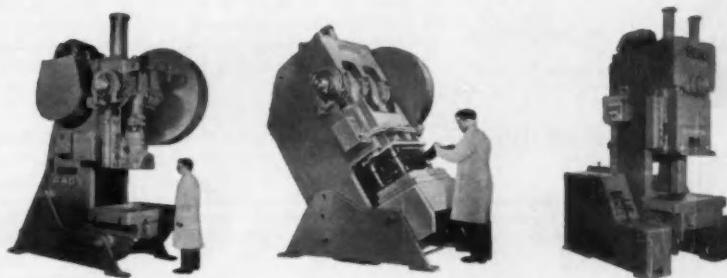
between re-grinds. Longer die life is one of the assured benefits from the rugged, rigid, all-welded steel Niagara frames.

Pacemaker of the press industry, Niagara has the most to offer in OBI's . . . whether it's the Single Crank Electro-Pneumatic Clutch type used in this G-E plant, the Double Crank type for long die area work or the revolutionary new Front-to-Back Crankshaft design in automated or standard models. Now that you have the G-E story, get the whole Niagara story, too. Request literature.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.  
DISTRICT OFFICES: Buffalo • Cleveland • Detroit • New York • Philadelphia

Dealers in principal U. S. cities and major foreign countries

# NIAGARA OBI PRESSES



# Again...

**FIRST  
and  
FOREMOST!**

An  
automatic  
time clock  
for  
tractors...



## The AC "SPLIT DIAL" Tach-Hourmeter!



FLINT  
1300 North Dort Highway  
CHICAGO  
Insurance Center Building  
DETROIT  
General Motors Building



For years, operators of off-the-road equipment were plagued with the problem of logging operating time for maintenance purposes. A straight time log could not do the job since maintenance requirements depend upon speed of engine operation as well as total time.

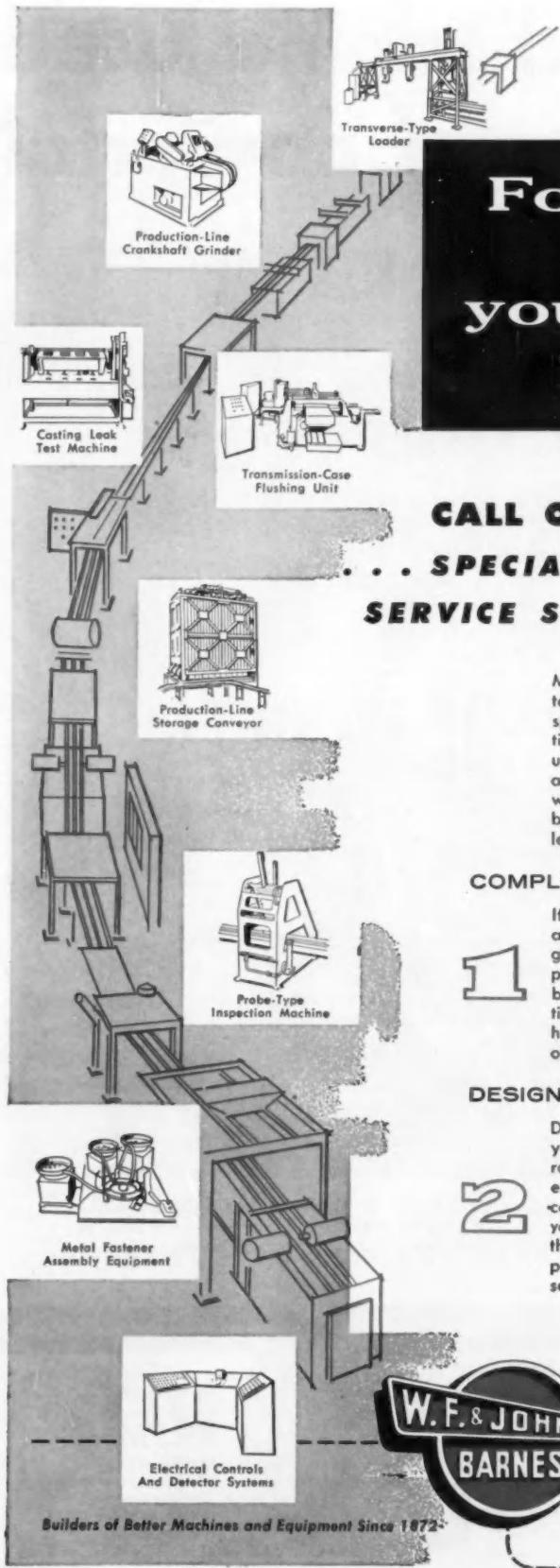
The solution came from AC engineers in 1951 when AC first introduced the "Split-Dial" Tach-Hourmeter designed for use on farm tractors. This one instrument supplied all this information in easy-to-read form: ground speed in miles per hour - calibrated for four or six different gearing ratios; engine speed in revolutions per minute; proper pulley speed; proper power take-off speed; accumulated engine time, compensated for engine speed during operation.

Today, AC manufactures variations of the "Split-Dial" Tach-Hourmeter for a wide variety of applications - boats, planes, and off-the-road equipment of every description.

Here is one more example of the ingenuity of AC engineers and of the aggressive spirit which keeps AC first and foremost in its field.

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS

ADAPTERS (DRIVE) • AIR CLEANERS • AIR CLEANERS AND SILENCERS (COMBINATION) • AMMETERS • BREATHERS (CRANKCASE) • CAPS (RADIATOR PRESSURE) • FLEXIBLE SHAFT ASSEMBLIES • FUEL PUMPS • FUEL AND VACUUM BOOSTER PUMPS (COMBINATION) • FUEL FILTERS & STRAINERS • GASOLINE STRAINERS • GAUGES—AIR (PRESSURE) • GAUGES—GASOLINE • GAUGES—OIL (PRESSURE) • GAUGES—TEMPERATURE (WATER, OIL) • OIL FILTERS (LUBE) • PANELS (INSTRUMENT) • RECIPROCATING VACUUM PUMPS • ROTARY VACUUM PUMPS • SPARK PLUGS • SPEEDOMETERS • TACHOMETERS • TERMINALS (IGNITION WIRE) • VALVES (CRANKCASE VENTILATION)



## For a practical solution to your automation problems . . .

**CALL ON W. F. & JOHN BARNES  
... SPECIAL TWO-FOLD COORDINATED  
SERVICE SOLVES PROBLEMS QUICKLY**

More and more production executives than ever before are today turning to Barnes for help in designing and building specialized automation equipment. With 80 years of practical machine building experience, Barnes have been called upon to design and build hundreds of different types of automatic handling and special processing equipment as well as special high production machine tools. Now, to better serve demands and help you solve automation problems quickly, Barnes offers a two-fold coordinated service:

### COMPLETE PRODUCTION-LINE ENGINEERING

If you are planning new production-line methods for either automatic or semi-automatic operations, an experienced engineering staff is available to work with you. The detailed plans and proposals submitted for your consideration can be depended upon to provide you with the latest in automation engineering and the very best of proven mechanical, hydraulic, and electrical actuation. Ask for a free survey of your problems early in your planning program.

### DESIGNING & BUILDING SPECIALIZED UNITS

Designing and building specialized, individual units to suit your specific needs is a separate, additional service. Where required, electrical, mechanical, hydraulic, fixture, and tool engineers work together as a team. All efforts are closely coordinated with complete manufacturing facilities to save you time and eliminate divided responsibility. As illustrated, this service covers hundreds of different types of automatic processing and work-handling units that are today profitably serving a wide range of industrial needs.

**ANALYSIS OF METHODS** — Call on Barnes engineers today for a practical solution to your automation problems. Or, ask for an analysis without obligation.

### AUTOMATION SECTION

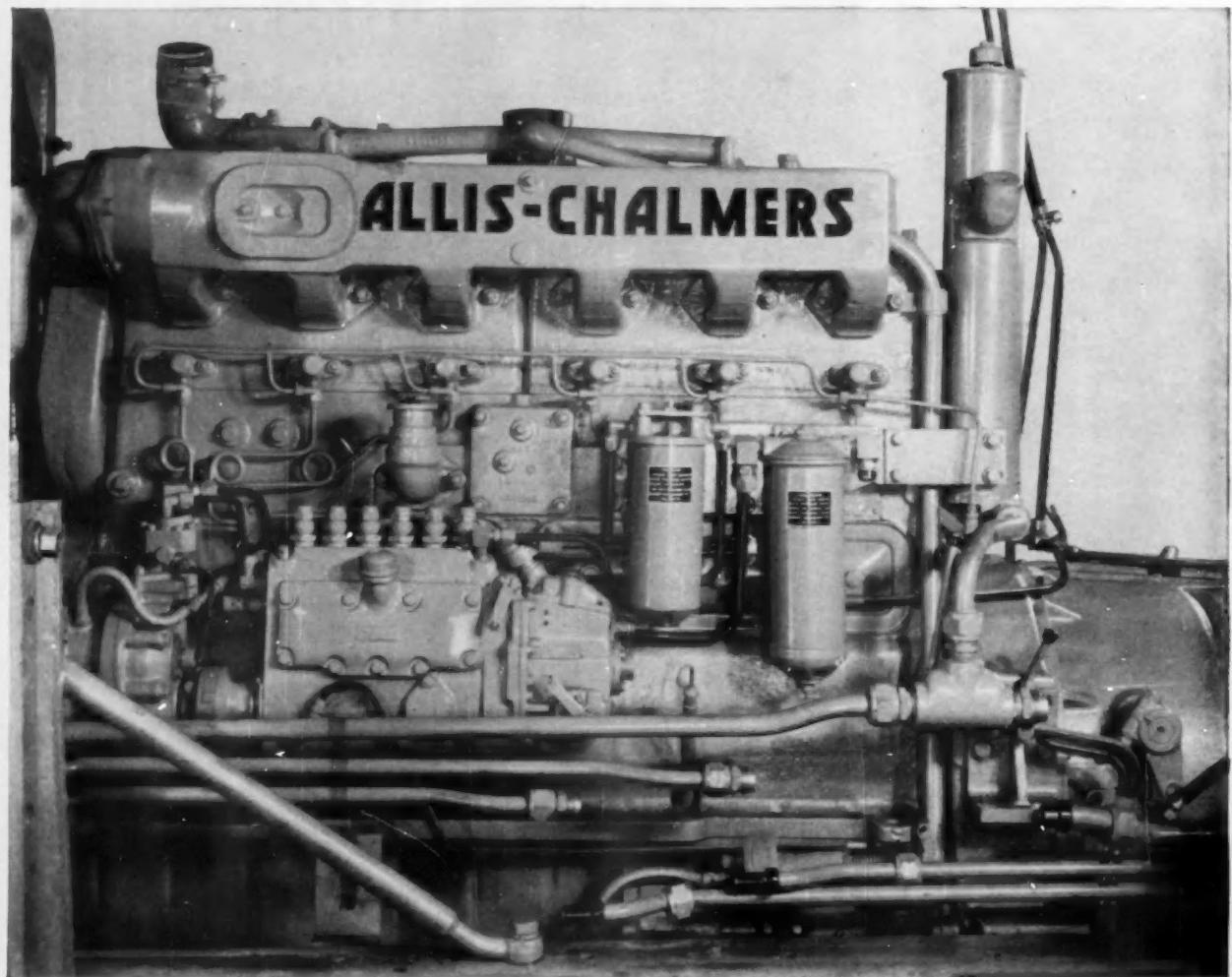
425 S. WATER ST. • ROCKFORD, ILLINOIS

SPECIAL MULTIPLE SPINDLE MACHINE TOOLS • SPECIAL PROCESS EQUIPMENT • SPECIAL ELECTRICAL CONTROLS

Builders of Better Machines and Equipment Since 1872



# Bundyweld Tubing used of powerful



Rugged Allis-Chalmers diesel engine, power plant of Model HD-21 crawler tractor shown on opposite page. Bundyweld Steel Tubing components are indicated here in its "from the mill" copper color, although several parts are actually solder-coated or painted on finished engine.

## BUNDYWELD IS DOUBLE-WALLED FROM A SINGLE STRIP



Bundyweld starts as a single strip of copper-coated steel. Then it's . . .



continuously rolled twice around laterally into a tube of uniform thickness, and



passed through a furnace. Copper coating fuses with steel. Result . . .



SIZES UP TO  $\frac{3}{8}$ " O.D.  
Bundyweld, double-walled and brazed through  $360^\circ$  of wall contact.



SIZES UP TO  $\frac{1}{2}$ " O.D.

NOTE the exclusive  
Bundy-developed  
beveled edges, which  
afford a smoother joint,  
absence of bead, and  
less chance for any  
leakage.

# for vital "lifelines" Allis-Chalmers crawler tractors



Model HD-21 Allis Chalmers crawler tractor, with bulldozer attachment, carves roadway through boulders. Regardless of the job or the terrain, you can count on its Bundyweld Steel Tubing parts to keep on functioning perfectly. Absolutely leakproof, it withstands heavy vibration fatigue and punishing wear.

## Diesel-powered, torque-converter-driven work horse relies on dependable double-walled steel tubing for fuel, lubrication, control and hydraulic lines

When Allis-Chalmers built this vehicle, they engineered it to take every kind of job in stride. When it came to tubing, they selected Bundyweld, proven in every type of vehicle made.

Bundyweld is thinner walled, yet stronger; is leakproof; has highest burst strength. It can be bent to smallest radii; takes easily to all standard coatings; withstands treatment and mistreatment that ruin ordinary tubing. Of exclusive construction, Bundyweld Tubing is

double-walled from a single steel strip, copper-bonded throughout 360° of wall contact.

But you get more than high quality with Bundyweld. Bundy Tubing Company backs its product with the world's finest fabrication service, plus engineering assistance to its customers at any stage of product development. Prompt, on-schedule deliveries, of course.

Let Bundy serve you. Call, write, or wire today!

**BUNDY TUBING COMPANY, DETROIT 14, MICHIGAN**

## BUNDYWELD TUBING®

Bundy Tubing Distributors and Representatives: Cambridge 42, Mass.: Austin-Hastings Co., Inc., 226 Birney St. • Chattanooga 2, Tenn.: Peirson-Deakins Co., 823-824 Chattanooga Bank Bldg. • Chicago 32, Ill.: Lapham-Hickey Co., 3333 W. 47th Place • Elizabeth, New Jersey: A. B. Murray Co., Inc., Post Office Box 476 • Los Angeles 58, Calif.: Tubesales, 5400 Alcoa Ave. • Philadelphia 3, Penn.: Rutan & Co., 1717 Sansom St. • San Francisco 10, Calif.: Pacific Metals Co., Ltd., 3100 19th St. • Seattle 4, Wash.: Eagle Metals Co., 4755 First Ave., South Toronto 5, Ontario, Canada: Aljoy Metal Sales, Ltd., 181 Fleet St., E. • Bundyweld nickel and Monel tubing are sold by distributors of nickel and nickel alloys in principal cities.

**WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING • AFFILIATED PLANTS IN AUSTRALIA, ENGLAND, FRANCE, ITALY, AND GERMANY**

*Precision Quality*

Balls  
of Steel  
Stainless Steel  
Brass, Bronze  
Monel Metal  
and  
Special  
Materials

for  
Over  
40  
Years

1966

**Strom STEEL BALL CO.**  
Largest Independent and Exclusive Metal Ball Manufacturer  
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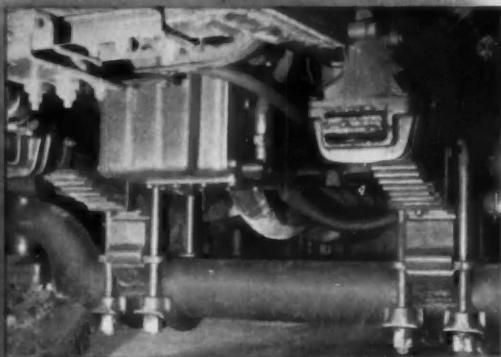
Pacific Coast Representative: R. J. SCHENK, 716 South Main Street, Santa Ana, Cal.  
Southwestern Representative: E. E. GRAHAM & CO., 3902 Navigation Blvd., Houston 3, Texas

## CALENDAR

### OF COMING SHOWS AND MEETINGS

- Truck-Trailer Manufacturers Association, summer meeting, Edgewater Beach Hotel, Chicago, Ill. .... July 19-20
- National Tool & Die Manufacturers Association, summer meeting, Stanley Hotel, Estes Park, Col. .... July 25-28
- Machine Tool Builders' Sales Conference, Purdue Univ., Lafayette, Ind. .... July 30-Aug. 3
- Air Force Association, national convention and airpower panorama, New Orleans, La. .... Aug. 1-5
- SAE National West Coast Meeting, Mark Hopkins Hotel, San Francisco, Calif. .... Aug. 6-8
- National Screw Machine Products Association, national sales conference, Wade Park Manor Hotel, Cleveland, O. .... Aug. 7-8
- Western Electronic Show and Convention, Los Angeles, Calif. .... Aug. 21-24
- International Ignition Conference, sponsored by Scintilla Div. of Bendix Aviation Corp., Sidney, N. Y. .... Aug. 22-24
- American Association of Motor Vehicle Administrators, annual conference, Royal Alexandra Hotel, Winnipeg, Manitoba, Canada .... Aug. 28-31
- National Aircraft Show, Oklahoma City, Okla. .... Sept. 1-3
- ASME Fall Meeting, Cosmopolitan Hotel, Denver, Colo. .... Sept. 10-12
- SAE National Tractor Meeting and Production, Forum, Hotel Schroeder, Milwaukee, Wis. .... Sept. 10-13
- National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J. .... Sept. 12-14
- Instrument - Automation Conference and Exhibit, Coliseum, New York, N. Y. .... Sept. 17-21
- International Commercial Motor Transport Show, Earls Court, London, England .... Sept. 21-29
- ASME Petroleum-Mechanical Engineering Conference, Conrad Hilton Hotel, Dallas Tex. .... Sept. 23-26
- Trade Fair of the Atomic Industry, Navy Pier, Chicago, Ill. .... Sept. 24-28
- Atomic Industrial Conference Forum, Morrison Hotel, Chicago, Ill. .... Sept. 25-27
- National Electronics Conference, Hotel Sherman, Chicago, Ill. .... Oct 1-3
- SAE National Aeronautic Meeting, Production Forum, and Engineering Display, Hotel Statler, Los Angeles, Calif. .... Oct. 2-6
- Paris Automobile Show, France. .... Oct. 4-14
- ASME - ASLE Third Lubrication Conference, Chalfonte-Haddon Hall, Atlantic City, N. J. .... Oct. 8-10
- National Metal Exposition, Public Auditorium, Cleveland, O. .... Oct. 8-12
- SAE National Transportation Meeting, Hotel New Yorker, New York, N. Y. .... Oct. 10-12
- American Society of Body Engineers, annual convention, Rackham Bldg., Detroit, Mich. .... Oct. 17-19
- International Motor Show, Earls Court, London, England. .... Oct. 17-27
- National Industrial Exposition & Management Conferences, Artillery Armory, Detroit, Mich. .... Oct. 22-26

"Where performance **Really**  
Counts!"



Heavy motor transport . . .  
on and off the highway . . .  
calls for the ultimate in  
performance from  
men and their machines

## BURTON AUTO SPRING CORP.

Vital Support for the Automotive Industry  
Western Avenue at Forty-eighth Street  
Chicago 32, Illinois

**H**ere's where performance really counts . . . and especially in the springs that cushion the shocks and carry the weight of vehicle and load. Where service is not easily available . . . parts and labor sources remote . . . and heavy tonnage in the balance, the time proven dependability of BURTON SPRINGS is an indispensable advantage. Burton "high-stability" springs as featured by Autocar, shown above in the service of a Texas contractor.

The services of Burton Auto Spring Corporation, with modern plant, adequate capacity, and highly qualified engineering staff is at YOUR disposal. Write us about your spring requirements now.

# FORESIGHT



## Planning for tomorrow • Producing for today!

Since the earliest days of the industry, Bendix foresight in product design and development has contributed materially to automotive progress.

For example, Bendix\* power braking and power steering, two of the industry's most popular new car features, are the results of years of research and engineering by Bendix specialists in these important fields.

Today Bendix engineers are likewise busy planning

and developing new and better products to meet the needs of the years ahead.

It is because of this foresight the automotive industry looks to Bendix for components that continue to lead in public acceptance and dependable performance.

**BENDIX PRODUCTS DIVISION SOUTH BEND INDIANA**

\*REG. U.S. PAT. OFF.  
Export Sales: Bendix International Division, 205 East 42nd Street, New York 17, N. Y.

### TYPICAL EXAMPLES



Bendix Power Brakes



Bendix Power Steering

**Bendix  
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Division**

**Bendix**  
AVIATION CORPORATION

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## High Spots of This Issue

### ★ New Era of Expansion

The recently authorized multi-billion dollar highway program inevitably spawns a vast market for mammoth quantities of materials and equipment. Discussed in detail here is its progressive impact on the automotive industries. Page 48.

### ★ Automatic Conveyor Systems in Foundry Operations

Manual handling is becoming a thing of the past in quite a few foundry operations, as seen in the Bendix Lake Shore plant at St. Joseph, Mich. How conveyor systems promote easier flow of work is analyzed in this article. Page 50.

### ★ Austin Makes Own Transfer Machines

Adoption of a "do-it-yourself" approach toward fulfilling its requirements for machinery has proved highly beneficial to the Austin factory in England. This is the story of how it was done and the benefits resulting. See Page 60.

### ★ How Windshield Reveal Moldings are Made

In the forefront of activities carried on by the Ternstedt Div. of General Motors Corp. is the manufacture of car windshield frames. Typical of the several stampings from which they are made is the side reveal molding. Page 54.

### ★ Chevrolet Willow Run Plant Assembles 21 Truck Models

Tremendous in its scope, the 500,000 sq ft facility at Willow Run operated by Chevrolet is a marvel of efficient heavy-duty truck production. The author presents an on-the-spot account of the techniques employed. See Page 66.

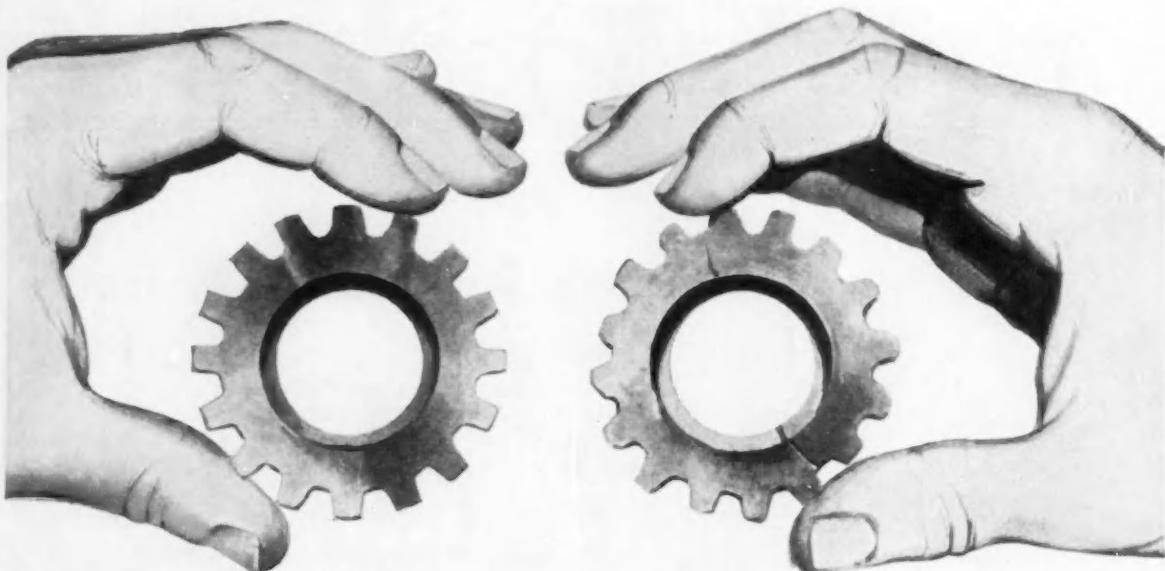
### 36 New Product Items

### And Other High Spots, Such As:

Plastics exposition and conference; sealed power Cyclan ring iron; Hydrostatic transmission; the cycle race; magnesium die castings; gearing needs; plastic jigs and fixtures; British universal joint; adhesives, coatings, sealers; Bradshaw free-piston gas generator; and heavy aircraft tooling.

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AUTOMOTIVE INDUSTRIES COVERS  
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES  
• BOATS • TRAILERS • ROAD MACHINERY • FARM MACHINERY  
PARTS AND COMPONENTS • ACCESSORIES • PRODUCTION EQUIPMENT  
ENGINEERING • SERVICE EQUIPMENT • MAINTENANCE EQUIPMENT  
PRODUCTION MANAGEMENT



## "What's wrong? They're both 8620 alloy steel!"

A Baltimore manufacturer was working on an order for oil pump gears of 8620 alloy steel. The first lot of steel attained satisfactory core hardness—but the second lot would not meet minimum hardness requirements.

Both lots were bought from a reputable source. What went wrong?

### The same alloy, sure—but different heats!

The manufacturer ran into trouble because the chemical composition and hardenability of different furnace heats of the same alloy can and do vary (within AISI and SAE limits) enough to have a marked effect on heat treatment response. As a result of such variation, the "right" alloy failed.

### Here's why this can't happen with Ryerson alloys

Unfailing protection against the hazards of

varying properties and hardenability is always yours when you specify and buy Ryerson certified alloys. That's because we test *your particular lot of steel* for heat treatment response, verify its chemical composition—and give you a record of these tests, keyed to the identification symbol on the steel.

So there's no guesswork—no need to rely on *typical* hardenability figures for your type of steel. With Ryerson certified alloys you know the *actual*, proved hardenability of the steel.

This extra assurance of quality doesn't cost you a cent—and it's only part of an 8-step quality control program to prevent the breakdown of equipment, the scrapping or reworking of rejects that may result when you're not sure of the alloys you buy. So next time—order Ryerson certified alloys and be sure.

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# News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 115, No. 2

July 15, 1956

## Thompson Shifts Operations From Fruitport To Detroit

Thompson Products, Inc., is expected to shut down its Fruitport, Mich., plant by Oct. 1, and move all operations to its new facility north of Detroit. Employing about 200 persons, the Fruitport unit has been turning out ball joint suspensions for Ford, Lincoln, and Mercury cars.

The new \$6 million plant north of Detroit also eventually will house all Thompson operations which are now located in the Detroit Conant Ave. works. Machinery from the old plant will be transferred to the new unit starting July 30.

The 390,000 sq ft plant features a number of manufacturing innovations, including conveyor systems and automated machines. Coupled with the plant layout scheme, they will move a part only 450 ft in the manufacturing cycle, compared with 2500 ft in the old plant.

## Some 1957 Cars to Retain Wheels With 15-In. Diam

Fourteen-in. wheels will not be used on all makes of 1957 cars. In general, lower and medium priced makes will carry the smaller diameters. Although some of the more expensive lines also will be on the smaller wheels, several will remain on present 15-in. wheels.

## Buick Using New Process For Testing Chrome Parts

Buick is using a new method to test chrome parts, which it says takes less than 10 per cent as much time as previous methods. In the new process, a mixture of chemicals, water, and clay is applied on the chrome parts to be tested.

The parts are then placed in a



HILLMAN MINX ASSUMES NEW SHAPES

The Rootes Group has introduced three new versions of the Hillman Minx in four-door hardtop and convertible models. Although they utilize many components and features of the Sunbeam Rapier, considerable cost savings have been effected. The new models are powered by the existing 85 cu in., four cylinder, ohv engine which now develops 51 bhp at 4600 rpm with an 8 to 1 compression ratio, according to specifications.

humidity oven where corrosion is accelerated by heat temperature of 100 F and humidity of 100 per cent. The test, which requires about 20 hours, is said to come closer to developing the types of corrosion produced in normal driving than previous methods.

## Texaco Doing Research Work On Free-Piston Power Plants

The Texas Co. has announced that it has underway a research program studying the fuel and lubricant needs of free-piston engines. Initial studies are being made on a single-cylinder, 60-hp SIGMA free-piston engine imported from France and recently delivered to Texaco's main research center at Beacon, N. Y. It is believed to be the first free-piston unit to be installed in a U. S. petroleum laboratory.

The new engine is being operated as an air compressor during the research studies. Its output is fed into the laboratory's air lines to add to the normal supply of compressed air.

## Ford Starts Expanding Chester, Pa., Facility

Work has started on expanding manufacturing space at Ford Division's Chester, Pa., assembly plant. The plant will not undergo any real physical expansion as such, with the exception of a 25,000 sq ft addition for the new-car preparation department now under construction. The additional manufacturing space will be provided once the present inventory of parts and accessories is moved to a new warehouse to be located in Delair, N. J.

Although the Delair unit will not be completed until 1957, rearrangement of the Chester plant for installation of new assembly lines and fixtures is possible by shifting parts inventories within the plant. A 100 per cent increase in manufacturing space at the plant reportedly will be possible when all inventories are shifted to the New Jersey unit. The entire modernization program at Chester will take about two years to complete, it is reported.

# News of the AUTOMOTIVE



## ADVANCED FIAT MODEL HAS SEVERAL NEW FEATURES

Horsepower of the Fiat 1400 B has been stepped up to 58 from the 50 hp of the 1400 car through improvements in the inlet and exhaust manifolds and an increase in the compression ratio from 7 to 1 to 7.5 to 1. This model is also available in a Diesel version with a four-cylinder engine that has a rated output of 43 bhp at 3200 rpm.

## Two Car Companies May Offer Convertibles With Steel Tops

"Hardtop convertibles," now a misnomer, may become just that before another year. At least two car makers have developed models in which the steel top actually retracts. The forward section telescopes into the rear part and the whole assembly retracts into a well in the trunk. They may be ready for production sometime during the 1957 model year.

## Approval of Argentine Plant Viewed Confidently by Kaiser

Kaiser Industries Corp. states that the Argentine Government's recent decision to lift the interdiction which had frozen the assets of the company's affiliate, Industrias Kaiser Argentina, is a vote of confidence in the project to provide Argentina with an automotive manufacturing plant. In fact, the company has completed arrangements to invest an additional \$1 million worth of equipment in the plant.

Industrias Kaiser Argentina produced its first ten Argentine-manufactured Jeeps in April, and 30 in May, with production increased to 100 for June. The company built in one year at Cordoba a plant with 800,000 sq ft of floor space.

The manufacturing schedule calls for 7000 vehicles to be completed by

the end of 1956. However, the plant is designed eventually to provide a one-shift capacity of 40,000 vehicles a year.

## Several Automotive Officials Among Victims of Air Crashes

The catastrophic crashes of two giant airliners in Arizona on June 30 claimed several automotive and one known aviation executive among its 128 victims. Carl J. Snyder, 59, vice-president and operating manager of Chrysler Corp., was among those who died in the fatal plunge of one of the planes.

Ford Motor Co. lost two of its outstanding attorneys in the deaths of Donald F. Kehl, 46, assistant general counsel, and Ted M. Kubinec, 37, a senior staff attorney. Bendix Aviation Corp. was represented on the casualty lists with the deaths of Noel Gottesman, 30, a researcher, and Russell A. Shields, 31, a senior research engineer.

Others who met untimely deaths in the air tragedy were: Floyd A. Nixon, 45, manager of plant operations for R. L. Polk Co.; John Muldoon, 56, sales engineer for Cogsdill Twist Drill Co. and president of Motorama Engineering, Inc.; and Jack B. Groshans, mid-eastern representative for Lockheed Aircraft Corp.

## York Shareholders Approve Merger With Borg-Warner

Shareholders of York Corp., York, Pa., have approved a proposal to merge their company with Borg-Warner Corp. A manufacturer of air conditioning equipment, York would have its name changed to Lauer Corp., with B-W assuming all the company's assets and liabilities.

## New Method For Shipping Windshields Cuts Costs

Chrysler Corporation, in cooperation with Flotepak Corp., of Detroit, has developed a new method for packaging automobile windshields and rear windows for shipments which is said to cut down cost appreciably. In the new packing method, the glass is suspended in the box by three supports which prevent it from moving laterally and vertically. Contact with the container and possible breakage is thus avoided.

The new method also provides a 15 per cent savings in warehousing space, since cartons now can be stored in a vertical position instead of horizontally, as previously. In addition, the method has cut down the gross weight of the container by 75 per cent. Previously, it was necessary to use solid wood boxes to ship the glass. Under the new method, a wirebound crate holds the glass firmly in place.

## Dual Headlamps To Be Optional On 1957 Cars

Dual headlamps, scheduled for introduction on several 1957 models, probably will be offered on an optional basis at the outset, primarily to conform with individual state laws, some of which do not permit the dual lighting. Headlamp housings will be designed to carry either one or two.

There is a possibility that the parking light may be located in one of the positions when the dual headlamps are not used. When dual lamps are used, both are smaller than the current type. Only one set of the lamps has the lower beam filament, with the other two not used except in highway driving.

# AND AVIATION INDUSTRIES

## Reynolds Sees Higher Aluminum Usage in Car Electrical Coils

Several leading automobile manufacturers are taking part in developmental work aimed at replacing the conventional copper-wire-wound electrical coils used in cars with coils wound with aluminum strip conductor, according to Reynolds Metals Co.

Several months ago, Reynolds announced the development of aluminum strip conductor interleaved with sheet insulation. Another new type of conductor was announced at the same time — aluminum strip self-insulated by an anodic film.

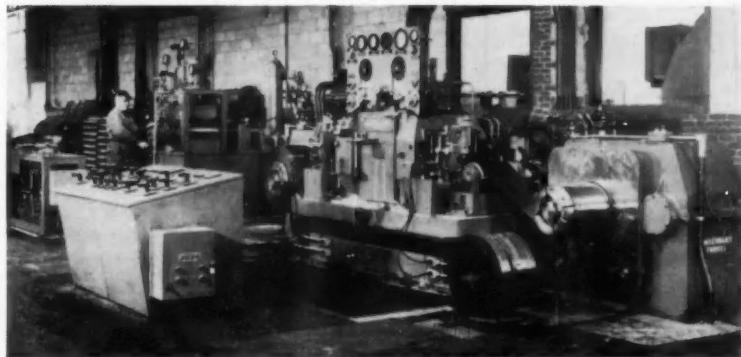
Advantages claimed for use in coils of both the strip conductor interleaved with paper, polyester films (such as Mylar) or other films and the strip conductor insulated with the anodic coating include: ease of winding; reduction of voids and reduction in thickness of insulation; reduction of layer to layer voltages; better heat transfer characteristics and elimination of many hot spot temperatures.

## Model Changeovers To Slash Car Output In Third Quarter

Despite slightly improved sales, output in the third quarter of this year is expected to be the lowest of any three-month period this year. This fact is certainly not surprising, since most plants once again will start closing down temporarily to get ready for the changeover to 1957 models. Car manufacturers also want to reduce current high inventories as much as possible to make way for the 1957 models.

The industry is expected to build about one million cars in the June-September period, which would be about 30 per cent under this year's second quarter output of 1.4 million. Although output in the third quarter is expected to be more than 50 per cent under the like quarter last year, fourth quarter output certainly should show substantial improvement. Initial output of 1957 models can be expected to be well underway by that time.

Studebaker-Packard last month completed production of 1956 Packard and Clipper models, the first



**ASC DIVISION INSTALLS NEW COLD-ROLLING MILL**

Recently placed in operation at the Forestville, Conn., plant of the Wallace Barnes Steel Div. of Associated Spring Corp. is this new 16-in. Sendzimir cold-rolling mill. Capable of rolling strip steel up to 13 in. wide, it will increase by up to 50 per cent the steel-rolling capacity of the Steel Division's facilities. The mill is said to be the largest of its kind in the spring industry and the first designed specifically to use a water-emulsifiable mineral oil as coolant and lubricant for the rolls. Automatic controls are extensively used throughout.

company to complete the current model run. There was no indication as to when output of 1957 models would start.

Any decisions from here on in obviously will be influenced by the ultimate outcome of negotiations between S-P and Curtiss-Wright Corp. Studebaker operations at South Bend, Ind., were continuing at press time.

Despite unusually low car production in June, the industry completed its third best first half on record. There were 3.1 million cars built in the January-June period. The figure was topped only by the first six months of 1953 and 1955.

The six months' production report showed that Cadillac and Lincoln were the only two car makers to build more units this year than in 1955. Cadillac turned out 84,376 cars, compared to 82,201 units in the first half of last year. Lincoln's output rose to 27,437 cars from 21,676 last year.

Production by the two independent makers — Studebaker-Packard and American Motors — was down drastically. The former turned out slightly more than 59,000 cars, against over 115,000 for the first six months of last year. Output of AMC dropped from 105,000 a year earlier to 60,000 during the first half of 1956.

## GM Personnel Changes Involve Six Divisions and Tech Center

A rejuggling of jobs in the General Motors' upper echelons last month has resulted in the creation of a new important position at the Technical Center, the appointment of new general managers at two of the car divisions, and the filling in of a post which has been vacant for two years. In addition, new general managers were named at four other divisions in the significant reorganization, the largest made by GM in several years.

Changes at the car divisions include the appointment of Edward N. Cole as general manager of Chevrolet to succeed Thomas H. Keating. Semon E. Knudsen has been named general manager of Pontiac to succeed Robert M. Critchfield. Harry F. Barr was made chief engineer of Chevrolet to succeed Mr. Cole. He was formerly an assistant chief engineer of the division.

Keating, general manager of Chevrolet since 1949, has been elevated to group executive in charge of the passenger car divisions, a position which has been vacant since the retirement of Harry J. Klinger in 1954. Critchfield, general manager of Pontiac since 1952, will be in charge of the process development staff at the Technical Center, a newly created

# News of the AUTOMOTIVE

position. This function formerly was a division of the manufacturing staff.

Changes at other GM divisions include the naming of Clyde W. Truxell, Jr., works manager of The Detroit Diesel Engine Div., as general manager of the division to succeed Knudsen; Edward A. Kaegi, general manager of The Detroit Transmission Div., as new general manager of the Brown-Lipe-Chapin Div.; O. William Habel, general works manager

of the Saginaw Steering Gear Div., as general manager of The Detroit Transmission Div., and Herman F. Lehman, general sales manager of Frigidaire, as general manager of that division.

Both Mason M. Roberts, general manager of Frigidaire, and Norman M. Ross, general manager of Brown-Lipe-Chapin until the recent changes, have retired after a combined 81 years' service with the corporation.

## 1956 WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

	For Weeks Ending				Jan. 1 through June 30, 1956
	June 30	June 23	June 16	June 9	
<b>PASSENGER CAR PRODUCTION</b>					
Hudson.....	336	114	416	0	18,102
Nash.....	1,201	215	1,140	0	42,163
Total—American Motors.....	1,539	329	1,565	0	60,265
Chrysler and Imperial.....	2,611	1,812	2,060	2,662	84,733
De Soto.....	1,893	1,901	1,967	2,087	57,070
Dodge.....	4,286	4,130	4,193	4,256	108,548
Plymouth.....	8,270	6,055	4,472	7,546	243,567
Total—Chrysler Corp.....	17,060	15,998	12,692	16,581	473,835
Ford.....	26,231	25,478	24,438	24,937	701,501
Lincoln and Continental.....	927	797	800	806	28,468
Mercury.....	5,499	4,886	5,195	5,304	138,881
Total—Ford Motor Company.....	32,657	30,961	30,434	31,047	868,848
Buick.....	7,275	8,571	9,534	9,555	322,271
Cadillac.....	2,597	3,168	3,184	3,193	84,376
Chevrolet.....	29,959	29,682	28,673	29,955	878,992
Oldsmobile.....	6,757	7,992	7,668	7,480	232,241
Pontiac.....	5,137	5,788	5,406	5,480	191,582
Total—General Motors Corp.....	51,725	56,201	54,465	55,843	1,729,362
Packard.....	61	601	494	505	13,253
Studebaker.....	120	1,162	962	1,250	48,544
Total—Studebaker-Packard Corp.....	181	1,783	1,456	1,755	59,797
Checker Cab.....	111	111	113	90	1,688
Total—Passenger Cars.....	103,273	105,263	100,725	105,086	3,193,895
<b>TRUCK PRODUCTION</b>					
Available.....	12	9	9	7	215
Chevrolet.....	5,487	7,091	6,901	6,756	180,303
G. M. C.....	1,665	1,586	1,626	1,848	51,437
Diamond T.....	96	106	100	102	2,541
Divco.....	80	80	74	80	2,179
Dodge and Fargo.....	1,867	1,805	1,533	1,905	45,099
Ford.....	6,269	5,611	5,575	6,160	160,905
International.....	2,371	2,404	2,331	2,707	73,357
Mack.....	506	381	239	232	9,676
Marmon-Herrington.....	25	24	19	17	299
Ree.....	78	88	79	90	1,943
Studebaker.....	120	314	311	334	7,857
White.....	387	382	379	387	9,834
Willys.....	1,390	1,377	1,304	671	31,123
Other Trucks.....	134	128	126	126	3,768
Total—Trucks.....	20,269	21,046	20,666	21,443	597,016
Buses.....	103	78	97	96	2,244
Total—Motor Vehicles.....	123,645	126,987	121,488	126,615	3,793,555

### Ford's New Terminal Can Handle Two Million Lb Of Parts Daily

Ford Division's new parts shipping terminal in Detroit, which went into operation June 4, can handle nearly three times more tonnage than the company's two previous terminals combined. Latest mechanical materials handling equipment, plus efficient layout, enable the terminal to move more than two million lb of automobile parts daily, compared with the 750,000-lb daily capacity of the two old units.

The 15,000 sq ft building serves as a focal point for receiving incoming parts shipments from suppliers. Parts are segregated into individual shipments to various Ford and Mercury assembly plants and most of Ford's parts depots.

### Latest Line of BMC Vehicles Features Lightness, Strength

A new line of lightweight trucks and small buses produced by the Austin and Morris motor companies has been announced by the British Motor Corp.

There are six new models—the Austin Omnivan, Omnitruck and Omnicar, and the Morris Light van, Light Pick-up and Light Minibus. New features include the setting-back of the engine, wide-vision curved windshields, integral body-welding, and sliding doors.

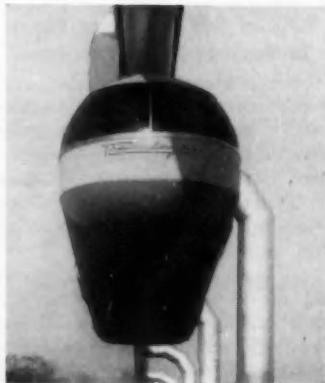
The Omnicar and Minibus seat, respectively, 9 and 12 passengers. Each has two hinged doors, one at the rear and at one at the side. The roof is lined with bituminous millboard for insulation and sound absorption.

The vehicles are powered by a four-cylinder, ohv engine developing 42 bhp at 4000 rpm. All are available with a left-hand drive.

### Superior Tool To Build New Plant At Toronto

Superior Tool & Die Co., Detroit, is planning to construct a 100,000 sq ft stamping and die plant in the Toronto area. To cost in the neighborhood of \$4 million, the new plant is expected to be ready for production early next year.

# AND AVIATION INDUSTRIES



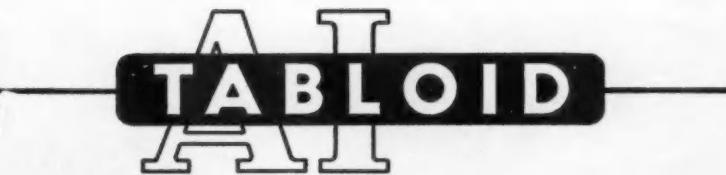
FLOATING TRANSIT CAR

Gliding along over a 970-ft freeway is the oval-shaped coach, with plastic exterior, of the Skyway Monorail in Houston, Tex. Equipped with 28 Goodyear pneumatic tires, it moves along a single steel rail suspended 18 ft over the ground. The pilot model of this new rapid transit system is powered by two 105-hp gasoline engines, but electric motors are planned for future units.

## Thompson Official Predicts Fabulous Car Output Growth

Speaking at the recent semi-annual meeting of the American Society of Mechanical Engineers, Arch T. Colwell, vice-president of Thompson Products, Inc., predicted that the American automobile industry will soon reach the nine-million mark in annual production of passenger vehicles. He went on to say that it may even hit the ten million mark within a few years.

Mr. Colwell also told his audience that: Gas turbine-powered automobiles will be coming off the production line as present production equipment requires replacement, probably appear one model at a time; fuel-injection systems for piston engines will come even before the gas turbine; changes in suspension systems are imminent, and springs and shock absorbers will give way to hydraulic and pneumatic cushions; America's highway system will expand rapidly to rival anything the world has ever known; and municipal parking and traffic problems will be solved by the complete elimination of on-street parking and the establishment of peripheral parking lots.



Detroit Broach Co., Inc., has changed its name to Detroit Broach & Machine Co.

Aluminum Co. of America will build a \$1.5 million aluminum die casting plant in Edison Township, N. J., to replace eventually its Garwood, N. J., plant.

Allis-Chalmers has introduced a new TS-260 motor scraper powered by a six-cylinder, 200-hp Diesel engine.

Ford Motor Co. of Canada recently turned out its 100,000th 1956 model passenger car at the Oakville, Ont., plant.

North American Aviation, Inc., will make rocket engines for the Air Force at a new plant now under construction at Neosho, Mo. . . . Aerojet-General Corp. will operate a new \$13 million plant near Sacramento, Calif., to make liquid-propellant rocket guided missile engines for the Air Force.

Lindberg Steel Treating Co. is expanding its Melrose Park, Ill., plant.

Joseph T. Ryerson & Son, Inc., will sell Reynolds Metals Co.'s aluminum throughout the areas served by its Chicago and Milwaukee plants.

Impact Extrusions, Inc., organized early this year, is now producing impact extrusions at Valparaiso, Ind.

General Electric Co. has built a modified version of its J47 jet engine that literally runs "red hot." . . . Goodyear Aircraft Corp. has developed two thrust reverser units designed to decrease landing runs of high-speed jet aircraft.

Carboloy Dept. of General Electric Co. will be known henceforth as the Metallurgical Products Dept.

Electric Auto-Lite Co. has formed a new company in Brazil to make parts for automotive ignition systems.

Jones & Laughlin Steel Corp. is planning a large integrated steel mill near Houston, Tex., with a capacity of a million tons of ingots a year.

Houdaille Industries, Inc., has purchased the assets of Wales-Strippit Corp. . . . Greenfield Tap & Die Corp. has acquired the assets of the Chuck Div. of E. Horton & Son Co.

Piasecki Aircraft Corp. has been awarded a Navy contract to build an experimental, automatic, unmanned, vertical lift aircraft.

American Bosch Arma Corp. is taking over the Chicago jet engine plant formerly operated by Studebaker-Packard Corp. for production of Air Force classified equipment.

Vickers, Inc., has become a partner with its licensees in both Australia and England.

P. R. Mallory & Co., Inc., has moved its New York district sales office to 545 Cedar Lane, Teaneck, N. J.

Power Products Corp. may develop a light two-stroke engine for a small car that would sell for \$500.

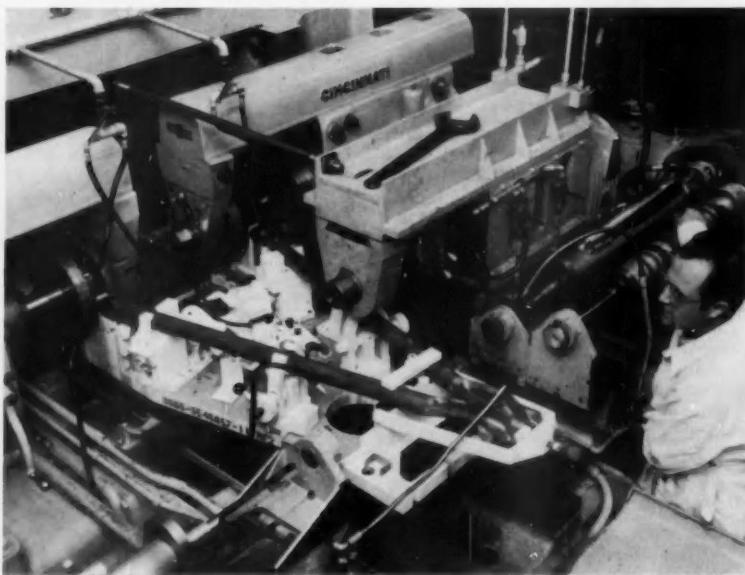
Motor Wheel Corp. will build a new plant to make automobile wheels, hubs, and drums on a 33-acre site located near Newark, Del. (Turn to page 158, please)

# News of the AUTOMOTIVE



## FLAT CAR ADAPTED TO HAUL AUTOMOTIVE FORGINGS

This "basket" car, designed by the Nickel Plate Railroad, saves time and expense in the loading and unloading of forgings for the automobile industry. Adapted from a standard flat car, the basket car carries 24 wire containers which are loaded and unloaded rapidly by a fork lift truck from ground level.



## AUTOMATED SPECIAL MACHINE CUTS DOUGLAS COSTS

This special duty milling and drilling machine at Douglas Aircraft Co. is designed and built around a standard Cincinnati duplex mill. It automatically machines heat-treated F4D arresting hooks at one setup in a fifth of the former operating time. A variable speed Romulus hydraulic head, whose capacity is boosted by bull gears, is built to the front of the mill. On its spindle are carried the three cutters that straddle-mill the clevis which, in flight, will accept the lowering and raising mechanism. Built to the front of this head are two modified Keller air feed drills that drill through the bushings shown. Opposite the second drill in line is the third Keller air drill (lower left).

## 90% of GM Employees Share In Savings-Stock Program

General Motors reports that nearly 90 per cent of its eligible employees are now participating in the corporation's combination savings-stock purchase program. Under the program, eligible employees are allowed to contribute up to 10 per cent of their salaries into the plan.

The corporation, in turn, invests half of the amount in Government bonds and the other half in GM common stock, with GM contributing an additional \$1 for each \$2 the employee invests in stock. All dividends and interest are reinvested for the employee. Since the program was inaugurated nine months ago, employees have contributed a total of \$32 million, and the corporation has donated \$16 million.

## Allis-Chalmers Forms Credit Unit To Help Finance Dealers

Designed to boost sales, a subsidiary to assist dealers finance the purchase of its machinery has been set up by Allis-Chalmers Manufacturing Co. To be known as Allis-Chalmers Credit Corp., the subsidiary was formed basically to furnish financial aid to dealers of farm equipment and construction machinery.

## Automotive Concerns Awarded Vehicle and Aircraft Orders

Part of the financial ache created in automotive production centers by labor layoffs is to be salved by new and sizable military vehicle orders. Output of the vehicles called for in the new contracts is expected to begin immediately and to result in a decline in the number of idle automobile workers.

The Detroit Tank-Automotive Command awarded Chevrolet Div. of General Motors Corp. contracts for vehicles totaling \$8 million. Of this sum, \$5 million will go for station wagons and sedans for the Army, Navy, and Air Force, while \$3 million will be used for various types of one-half ton trucks for the Army and Navy. Additional contracts totaling \$3 million to be awarded to GMC for heavier vehicles were still pending at press time.

# AND AVIATION INDUSTRIES

Chrysler Corp. received a \$4.1 million Army truck contract calling for 1805 civilian-type vehicles ranging from light to heavy units. The corporation's Fargo Div. was also slated at press time to receive an additional award totaling \$2 million for one-half ton and two-ton trucks. Smaller contracts were also set to go to Willys Motors and International Harvester.

## Aircraft Contracts Also Granted

Meanwhile, Ford Motor Co. announced that its Aircraft Engine Div. in Chicago has received a \$188 million contract for additional J-57 turboprop engines to be used in the B-52 intercontinental bomber. The latest award, one of the largest received by Ford in many months, brings to more than \$1 billion the total value of J-57 orders which the company has either on hand or already filled.

Chrysler Corp. simultaneously received a \$3.1 million contract from Army Ordnance to produce the new 1500-mile-range guided missile, the "Jupiter," and indications were that other similar contracts would be forthcoming to Chrysler. Most of the work on the missile will be done at the Government-owned plant north of Detroit which Chrysler operates.

Kelsey-Hayes Wheel Co. was the recipient of a smaller contract awarded by the Air Force. Valued at \$2.7 million, the contract calls for preparation of machinery to produce jet engine parts. A production contract is expected to follow.

## Some Car Makers Study Plans For Three-Year Body Changes

Two-year vs. three-year cycles of major body changes is getting some serious consideration by car makers. Most will be on a two-year cycle with 1957's, but, after the experience this year, some automobile companies are beginning to wonder whether it is economically sound and desirable.

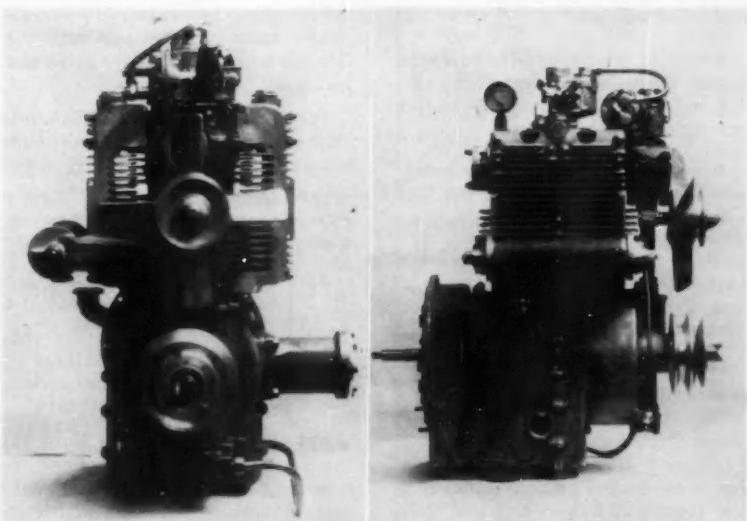
They are said to fear that the public will hold back in the off-year if they expect fresh styling regularly every second model year. Monumental tooling costs also enter into the considerations. It seems likely that at least part of the industry may go for



**ITALIAN TRUCK WITH V-8 DIESEL POWER PLANT**

The OM Super-Orione truck is powered by a 90-deg., 170-hp V-8 Diesel engine of the direct injection type. Carrying a useful load of eight tons, the vehicle is equipped with an eight-speed gearbox, semi-elliptic springs, 24-volt electrical system.

the three-year cycle with substantial modifications in the two intervening years to alter exterior appearances. (Turn to page 94, please)



**FRENCH ENGINE MAINTAINS CONSTANT PRESSURE**

Tests have just been carried out in a Paris laboratory on a four-stroke, constant-pressure engine designed by French engineer Marcel Violet. This aircooled vertical twin of 30.5 cu in. displacement incorporates a spring-loaded rotary valve in the head that runs at half engine speed. This valve handles all of the incoming fuel and air mixture, but only 10 per cent of the exhaust gas. The remaining 90 per cent is released through the ports uncovered by the piston at the lower end of its stroke. It is claimed that this design makes it possible to hold in the cylinders a layer of spent gases not mixed with the fresh charge; as a result, fuel consumption per horsepower-hour is nearly constant through the whole range of operation. A manufacturing license for the Violet engine has been taken up by the Bugatti Automobile Co., according to informed sources.

# Men in the News



Potter & Johnston  
Co.—William L. Martin has been named sales manager.

**Chrysler Corp.**—John D. Moran was appointed Director of Organization.

**Ford Motor Co.**—Thomas J. O'Neil has been named Dealer Policy Board associate; John B. Millis, assistant to the chairman of the board; and Duane D. Freese, executive secretary.

**Chevrolet Motor Div., General Motors Corp.**—William C. Schartow has been named manager of the Grey Iron Foundry.

**Raybestos-Manhattan (Canada), Ltd.**—J. Stewart Munro is now president, and Douglas Pocock has been made vice-president of replacement sales.

**Eaton Mfg. Co., Axle Div.**—Chester D. Christie has been appointed assistant chief engineer.

**American Brakeblok Div., American Brake Shoe Co.**—Henry Wehr, Jr., has been appointed sales promotion and advertising manager.

**American Motors Corp., Automotive Div.**—Wallace S. Berry has been appointed director of research.

**Oldsmobile Div., General Motors Corp.**—Elmer O. Corbin is now general superintendent in charge of operations at the forge plant.

**Westinghouse Electric Corp.**—R. A. Morgan has been chosen manager of advertising and sales promotion for the central region of the Apparatus Div.; and Thomas J. Farrahy, Jr., has been made assistant manager of the Industrial Advertising and Sales Promotion Dept.

**H. K. Porter Co., Inc.**—Lawrence L. Garber has been named vice-president in charge of production, while Eugene Salinger succeeds him as general manager of the Henry Dissston Div.

**Heppenstall Co.**—Lloyd R. Cooper is now chief engineer.

**Ross Operating Valve Co.**—Carl Halpin has been made manager of engineering.

**Kurt Orban Co., Inc., Steel Div.**—Stanley Lambert has been elected a vice-president and sales manager.

**Seiberling Rubber Co.**—Jerome C. Isham is now manager of the Public Relations Dept.

**Conoflow Corp.**—Robert W. Stanton, Jr., was appointed advertising manager.

**Warner Electric Brake & Clutch Co.**—John Erbach has become sales engineer.

**Twin Coach Co., Aircraft Div.**—Stuart N. Smith has been named vice-president in charge of manufacturing, and George R. Hecht has been promoted to vice-president in charge of contracts administration.

**Canadian Automotive Trim, Ltd.**—Philip E. Church was elected president, and John G. Bannister was named chairman.

**Metal & Thermit Corp.**—A. James Fisher has been made general sales manager.

**Air Associates, Inc.**—Charles A. Sereno was elected executive vice-president.

**Progressive Welder Sales Co.**—John D. Gordon was named general sales manager.

**Joy Manufacturing Co.**—John P. Cartwright is now sales manager for industrial sales.

**Fosdick Machine Tool Co.**—Clark R. Hibbard has been promoted to sales manager.

**Hycon Mfg. Co.**—William C. McFadden has been appointed executive vice-president.

**Oxy-Catalyst, Inc.**—Van Horn Ely, Jr., has been named president and treasurer. He succeeds Eugene J. Houdry, who is now chairman of the board.

**American Bosch Arma Corp.**—Harry M. Frey is now assistant to the corporate vice-president for administration.

**Garrett Corp.**—Harry H. Wetzel, Jr., has been appointed assistant to the president.

**Huck Manufacturing Co.**—Robert

**New York Air Brake Co.**—Karl W. Galliger was appointed director of engineering.



**H. Butt** is now manager of the Field Engineering Dept.

**Formsprag Co.**—James Vincent Huebner has become assistant manager of the Application Engineering Dept.

**Electric Storage Battery Co.**—Clifton G. Grimes has become director of research, succeeding L. E. Lighton, retired.

**Leeds & Northrup Co.**—Donald E. Moat is now director of marketing.

**R. L. Kuss & Co., Inc.**—Warren Simpson has been appointed chief engineer.

**Ford Div., Ford Motor Co.**—Sanford Kaplan and Donald J. Bastian have been appointed executive assistant to the general manager and plant operations manager, respectively.

**Vickers, Inc.**—Duncan Gardiner has been named director of research and development.

**Yale & Towne Mfg. Co.**—Michael F. Ryan has been promoted to manufacturing assistant to the general manager, and George A. Smith is now production manager of the Yale Materials Handling Div.

**Detroit Broach & Machine Co.**—Joseph P. Chayka has been advanced to chief engineer.

**Standard Pressed Steel Co.**—Leonard H. Clark has been made assistant to the vice-president of sales.

**Fenwal Electronics, Inc.**—Robert S. Goodyear has been named president.

**Kearney & Trecker Corp.**—J. Robert Jones was elected vice-president in charge of sales; H. W. Kippers was named sales manager of the Standard Machinery Div.; and Carl F. Enroth was appointed sales manager in the Special Machinery Div.

**Maremont Automotive Products, Inc.**—John P. Buck has been promoted to vice-president in charge of manufacturing.



*Chrysler Export Corp.—E. C. Row was elected president and a director, succeeding the late C. B. Thomas.*

**Electric Auto-Lite Co.**—**Ernest H. Voges** has been appointed marketing research manager.

**Raybestos-Manhattan, Inc.**—**H. H. Burrows** has been named senior vice-president of the Rubber Sales Div.; **R. B. Hazard**, vice-president and sales manager for rubber and packings; **S. J. Synnott**, assistant sales manager for rubber products; and **C. V. Vetell**, manager of rubber products sales.

**Friez Div., Bendix Aviation Corp.**—**Vernon D. Hauck** is now assistant general manager.

**Dow Corning Corp.**—**Robert S. Argyle** has been named manager of advertising, sales promotion, and publicity.

**Canadian Westinghouse Co., Ltd.**—**H. N. Muller, Jr.**, has been appointed chief engineer.

**Minneapolis - Honeywell Regulator Co.**—**Glen E. Seidel** has been appointed vice-president in charge of engineering.

**Mercury Div., Ford Motor Co.**—**Paul F. Lorenz** was named executive assistant to the general manager, and **Siffrein H. Vass** succeeds him as controller.

**Wagner Electric Corp.**—**C. E. Widell** was appointed director of research and development for automotive and electrical engineering; **P. J. Reese**, assistant director of research and development; **E. E. Wallace**, chief product engineer, automotive and industrial brake products; and **W. R. Freeman**, consulting engineer on automotive product design and research and development.

**Baker-Raulang Co.**—**John A. Matousek** has been named assistant to the president.

**Bendix International Div., Bendix Aviation Corp.**—**Donald E. Davidson** is now West Coast manager.

**Pratt & Whitney Co.**—**Edward N. Clark** is now assistant to the factory manager of the Cutting Tool and Gage Div., and **Ralph Winspear** has become superintendent of the Cutting Tool Div.

**International Harvester Co.**—**Howard S. Manwaring** has been promoted to director of engineering.

**R. G. LeTourneau, Inc.**—**Stan Fain** has been appointed advertising supervisor.

**Consolidated Electrodynamics Corp.**—**Philip S. Fogg** has been named chairman of the board, and **Hugh F. Colvin** succeeds him as president. **Rodney W. Meyer** has become export sales manager.

**General Electric Co.**—**Charles J. Falk** has been appointed manager of engineering for the Distribution Assemblies Dept.

**Ford Motor Co., Special Products Div.**—**Gordon W. Doherty** has been named purchasing agent for the Stampings Dept., and **Miles Lilly** is now dealer placement manager.

**Carbology Dept., General Electric Co.**—**Bruce M. Sheffer** was appointed manager of advanced manufacturing engineering.

**Allen Electric and Equipment Co.**—**Wade W. Allen** was elected president.

**Budd Co.**—**Joseph L. Eastwick** has been elected a member of the board of directors.

**Fruehauf Trailer Co.**—**A. H. Plumpe** has been named manager of the Delphos, O., plant.

**Hamilton Standard Div., United Aircraft Corp.**—**Ted C. Fisher** has been named administrative engineer, and **Herbert N. Reitz** is now senior project engineer.

**Four Wheel Drive Auto Co.**—**Louis A. Wehde** has been made assistant sales manager.

**Park Chemical Co.**—**H. D. Kitchen** has been elected executive vice-president and secretary; **C. R. Foreman**, vice-president in charge of sales; and **Robert J. Mitchell**, treasurer.

**Hunter Spring Co.**—**Frank A. Votta, Jr.**, has been made chief engineer.

**Wellman Bronze & Aluminum Co.**—**Edward C. Williams, Jr.**, has been named manager of customer relations.

**International Harvester Co., Motor Truck Div.**—**Samuel G. Johnson** has been named assistant manager of engineering.

**Chrysler Corp. of Canada, Ltd.**—**Ron W. Todgham** has been appointed executive vice-president.

**Bell Aircraft Corp.**—**Edward K. Paul** has been named administrative assistant to the vice-president and general manager.

*Cadillac Motor Car Div., General Motors Corp.—Warren R. Jolymore has been made director of public relations.*



**Chevrolet Motor Div., General Motors Corp.**—**C. J. French** is now assistant manager of the new Factory-Dealer Relations Dept.

**Republic Aviation Corp.**—**Henry V. Beuttell** has been appointed general manager of Republic's European subsidiary.

**Superior Steel Corp.**—**Col. William L. McCulla, ret.**, has been named chief engineer.

**Raybestos-Manhattan, Inc., Wabash Div.**—**Clarence P. Schneider** was chosen general manager; **Norman L. Caldwell**, factory manager; **Ben T. Collins**, director of research and product development; and **LeRoy Musselman**, division comptroller.

*(Turn to page 156, please)*

### Necrology

**Louis C. Brooks**, 86, retired secretary-treasurer of Kelsey-Hayes Wheel Co., died June 16, at St. Petersburg, Fla.

**Frank A. Garry, Sr.**, 61, purchasing agent for the Cadillac Cleveland tank plant, died June 30, at Lakewood, O.

**Marshal L. Noel**, 50, former vice-president and general sales manager of the Tractor Div. of Allis-Chalmers Mfg. Co., was killed in the recent crash of a Venezuelan airliner.

**Joseph F. Taylor**, 67, chairman of the board of Bausch & Lomb Optical Co., died June 13, at Brighton, N. Y.

**Herman Penner**, 79, pioneer automotive designer, died June 13, at Milwaukee, Wis.

**Harold D. North**, 72, chairman of the board of Ferry Cap & Set Screw Co., died June 25, at Cleveland, O.

**Robert C. Burlan, Sr.**, 62, Plymouth western zone sales manager, died June 24, at Los Angeles, Calif.

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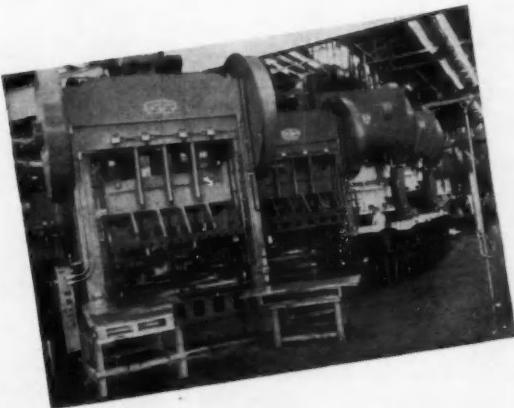
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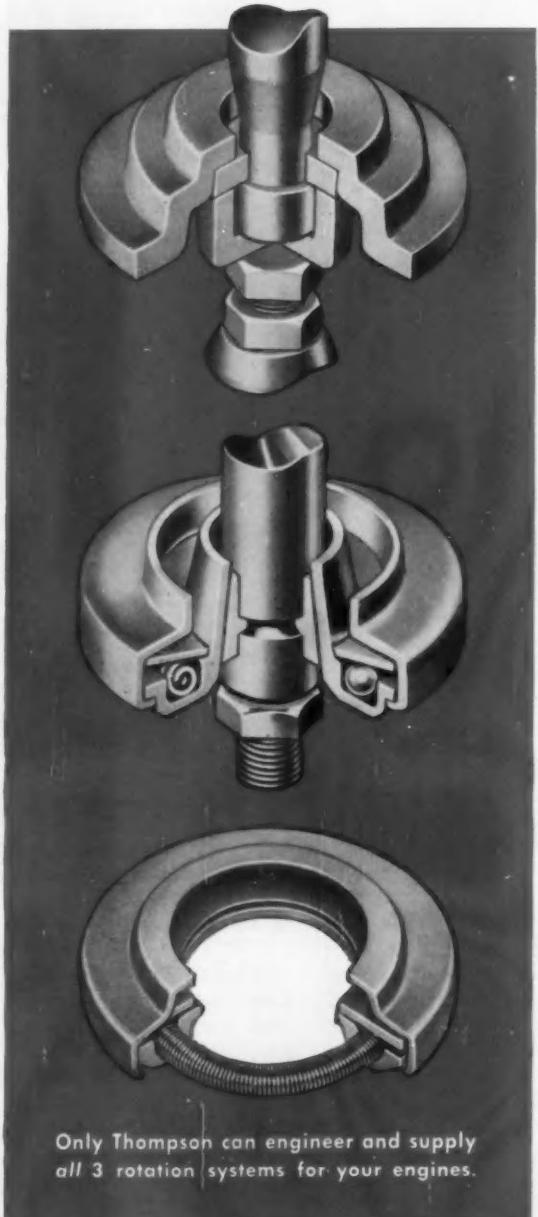
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## Valve Division **Thompson Products, Inc.**

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# How gasket width affects the unit load required to maintain constant compression

An increase or decrease in gasket width does not always indicate that a change in the unit load is required to maintain constant compression. The type of gasket material used is the determining factor in most cases, as the examples below illustrate.

## rubber gaskets

Since rubber is noncompressible, its load compression curve varies with the ratio of load area to free area. An increase in gasket width acts to impede sideflow, because it introduces additional material that must be displaced. To offset the added resistance, unit load must be raised to maintain constant compression. (It follows, of course, that the unit load must be reduced if the gasket width is decreased.) As shown in Figure 1, doubling the width of Armstrong DO-176—a

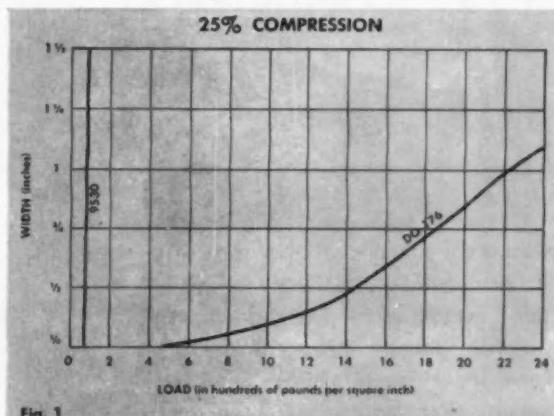


Fig. 1

straight rubber material—steps up the required unit load from 1400 psi for a  $\frac{1}{2}$ -inch gasket to 2200 psi for a 1-inch gasket.

## cork composition

Cork composition, on the other hand, is truly compressible. There is no problem of resistance to sideflow—because there is no sideflow. As shown in the curve for Armstrong 9530 Cork Composition (Figure 1), a unit load of 75 psi produces 25 percent compression regardless of gasket width.

## cork-and-rubber

The properties of cork-and-rubber can be modified by combining the two materials in varying proportions. For example, Armstrong DC-167 Cork-and-Rubber material has a high cork content. Its behavior, therefore, approaches that of Armstrong 9530 Cork Composition. To maintain constant compression with DC-167, unit load increases only from 110 psi to 120 psi when gasket width is increased from  $\frac{1}{2}$  inch to 1 inch (Figure 2).

With Armstrong DC-113 Cork-and-Rubber, gasket behavior will be more rubber-like because of the material's relatively low cork content. Figure 2 shows that 660 psi are needed to produce 25 percent com-

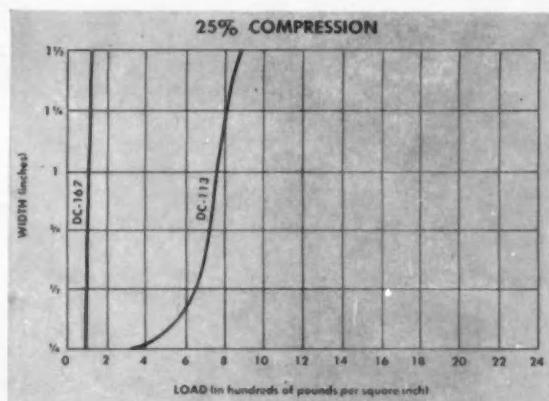


Fig. 2

pression on a  $\frac{1}{2}$ -inch gasket. When width is increased to 1 inch, a load of 780 psi is required. Other Armstrong cork-and-rubber compositions provide intermediate degrees of compressibility to meet particular requirements.

The curves on this page illustrate why a compression specification should always state the sample gasket size, particularly with straight rubber compounds.

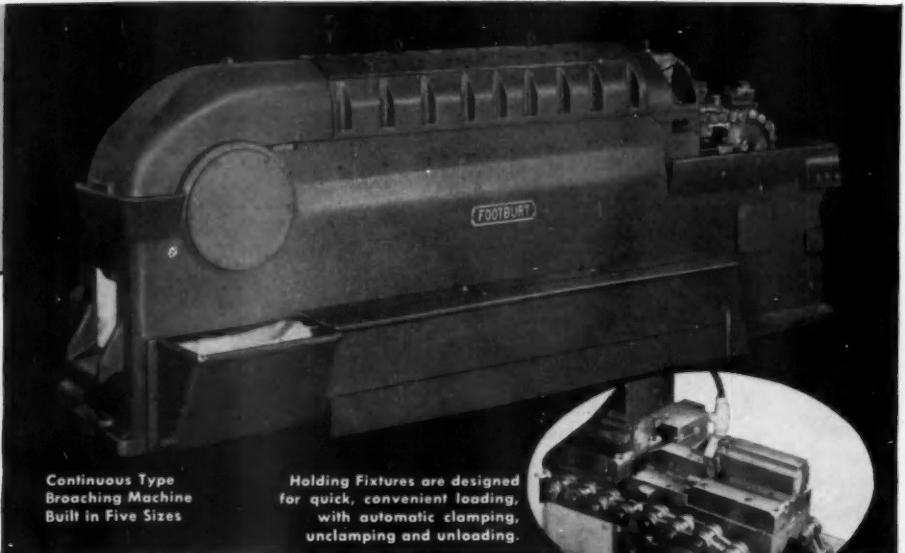
## SEND FOR 24-PAGE GASKET MANUAL

You'll find other useful information on the design and use of gaskets in the new Armstrong Gasket Design Manual. Write for your copy to Armstrong Cork Company, Industrial Division, 7107 Imperial Ave., Lancaster, Pa. For information on all Armstrong Gasket Materials, see Sweet's product design file.



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Mechanical Goods Division

**United States Rubber**

# NEW ERA OF -E-X-P-A-N-S-I-O-N-

Multi-Billion Dollar Highway Program to Enlarge Many Segments of United States Economy. Huge Quantities of Equipment and Materials Will Be Required to Build Modern Network Throughout Nation

By James R. Custer

**N**ow that the Federal-Aid Highway Act of 1956 is law, it marks the beginning of a new era of expansion that will accelerate business activity and employment in the years ahead everywhere in the United States.

Within the next two or three months, construction work on the first projects of this new Federal-aid highway program will get underway. Over a 16-year period the Federal Government will spend approximately \$25 billion and the states about \$3 billion to complete the Interstate Highway System of 41,000 miles.

This year the outlay for construction of highways, roads and streets will total about \$5.5 billion, an all-time high. Including the new Federal program, the total is expected to go to \$7 billion in 1958, to \$8 billion in 1959, and to level off between an \$8 and \$9 billion annually by 1960. It is the greatest public works program in the history of the world and will produce a new network of modern highways traversing every state in the Nation.

Directly, this program will have a big effect on the production of road building materials, such as cement, aggregates, bituminous materials, and steel; also road-building equipment and road maintenance materials.

As the new network grows, industrial and residential expansion naturally will follow the new expressways. These changes will not occur overnight, but will develop section by section as road systems are completed. In addition to expressways, included in the program are new primary, secondary and urban highways. Increasing motor transportation likewise will result and that means a greater market for motor vehicles and petroleum products.

In 1955 highway construction contractors employed  
(Turn to page 168, please)

TABLE I  
Equipment Available for Highway Contract Construction as of January 1, 1956

Description	No. Units
<b>Construction Machinery and Allied Equipment</b>	
Tractors, Crawler(1)	33,000
Tractors, 2 and 4 Wheel (Contractors Type)	9,300
Scrapers, Hauling (All Types)	17,200
Off-highway Hauling Equipment (End, Side and Bottom Dumps)	11,200
Power Cranes & Shovels	16,500
Motor Graders	15,100
Rollers, All Types	13,000
Loaders, Front End, Wheel	6,500
Ditchers & Trenchers	1,210
Hydraulic Hoists & Dump Bodies(2)	70,000
Air Compressors, Portable	13,750
Batching Plants, Concrete	4,000
Concrete Mixers, Portable	5,200
Contractor Pumps	41,500
Concrete Pavers	1,125
Concrete Spreaders	1,525
Concrete Finishers	1,525
Truck Mixers & Agitators	7,300
Asphalt Plants, Portable	2,000
Bituminous Pavers (Spreaders-Finishers)	3,040
Bituminous Distributors, Truck Mounted	6,500
Crushing & Screening Plants, Portable	2,300
Miscellaneous Units (10%)	20,928
<b>Subtotal</b>	<b>233,703</b>
<b>Motor Vehicles</b>	
Pickups & Autos	11,825
Trucks, 1½ - 3 Tons	42,350
Trucks, over 3 Tons	38,720
Trucks, Miscellaneous	4,050
<b>Subtotal</b>	<b>96,945</b>
<b>Grand Total</b>	<b>330,648</b>

(1) Including attachments and power control units.

(2) Not in total, included as integral parts of trucks and off-highway hauling equipment.

# SPI Holds 7th National Plastics Exposition and Conference

**A**UTOMOTIVE and aircraft uses of plastics held a good share of the spotlight at the 7th National Plastics Exposition and Conference in New York City last month. There were more than 300 impressive and informative exhibits prepared by 235 companies in the plastics industry and just about everyone had something for the automotive industries.

At the opening of the show, Norman Anderson, President of the Society of the Plastics Industry and president of General Molded Products, stated that gross sales for the industry are expected to exceed \$2 billion and plastics production will jump to 4 billion pounds this year. If this prediction holds, this year will mark the largest ever in the plastics industry.

Reports received from exhibitors and visitors alike indicated a very favorable reaction to the exposition. Over 25,000 industry people looked over the exhibits of basic plastics material, forming methods, and allied items.

## EXHIBITS

Du Pont had a very interesting exhibit set up with color television cameras and receivers on a closed circuit system. The company showed not only its own products but the plastic items of other raw material manufacturers. A regular schedule was established to keep show visitors informed on the latest news in the plastics field. The Polymers Div. of du Pont displayed many automotive products made of such du Pont plastics as Zytel nylon, acrylics, polyethylene, and others. In another du Pont booth, the properties and uses of Mylar were promoted.

Bakelite showed a host of applications of its plastics in the automotive field. One item of interest was the special polyester which is currently being used to impregnate aluminum castings. This material is being used by some large aircraft manufacturers for engine castings where temperature requirements do not exceed 400 F.

Celanese had a refrigerator truck body on display which was made of Marco polyester resin. It also exhibited some automotive products made of cellulose propionate.

Hooker Electrochemical had some very interesting material on its fire-resistant polyester resin and on a new resin used in making foundry castings. Both products are being used in the aircraft and automotive field.

Goodyear Aircraft displayed some of the parts it is making for the Chevrolet Corvette program. In addition,

Goodyear showed some other commercial and military applications such as fin tips, canopies, radomes, arm rest panels, and farm equipment components.

The 3/4-scale plastic car sponsored by Monsanto aroused much interest in the company's products. Shell mold resins and the vinyls made by Monsanto were also given a play to automotive visitors to the show.

U. S. Rubber's Royalite was shown in several passenger car applications. The company's Naugatuck Chemical division exhibited polyvinyl chloride resins and polyesters for passenger car, truck, farm equipment, and aircraft use.

Rohm & Haas gave some examples of acrylics for automobile tail light applications and showed other interesting applications for its polyester and vinyl compounds in the automotive line.

At the conference, there were several speakers from the automotive and aircraft industries. Extracts of papers given by two of the speakers are presented herewith.

## Plastics Automotive Components

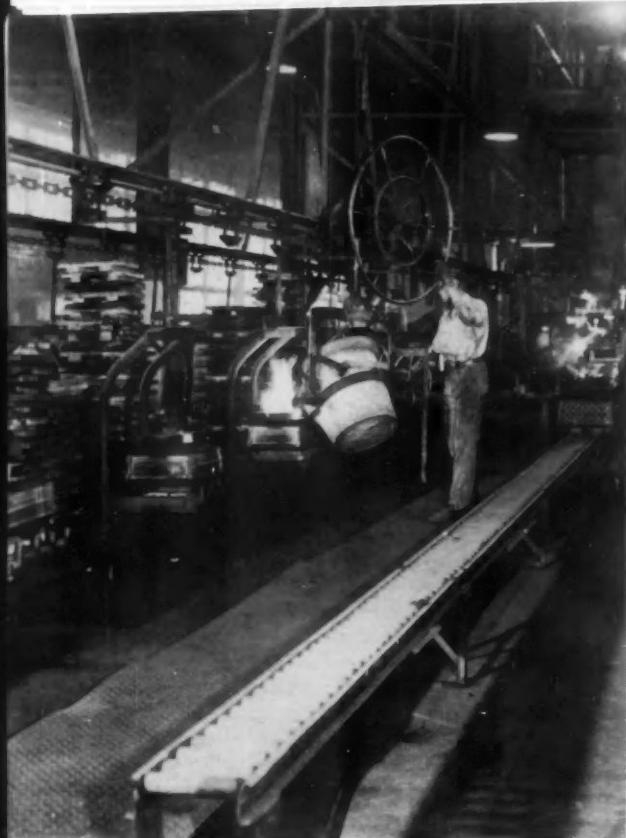
By Dr. A. J. Carter

*Chrysler Corp.*

THE use of printed circuits on phenolic laminates is being carefully investigated by automotive electrical engineers of all the companies. Production trial runs have already been made utilizing them in car radios. Whether they will be used this coming year is dependent upon cost only. If the volume is large enough to amortize the tooling required, this setup will be used. The major materials problem concerned was to develop a laminate which could withstand, without warping, the processes involved in putting on the circuits and the extremes in temperature and humidity to which cars are subjected. What works successfully in a home radio does not necessarily perform satisfactorily in an automobile unit.

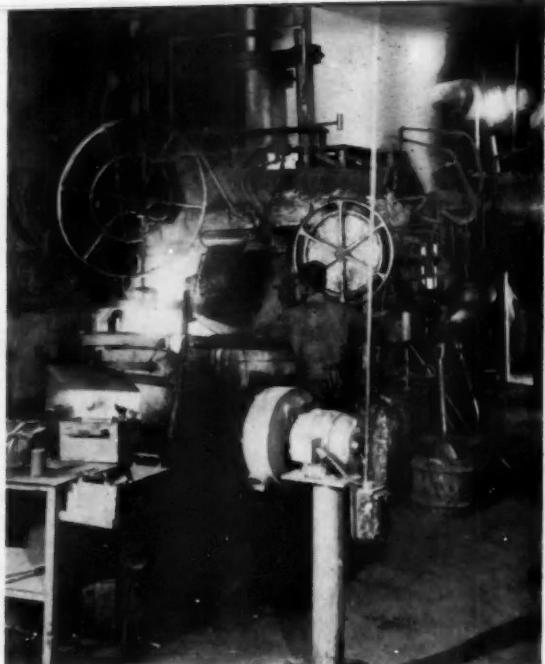
To my knowledge, the only other printed circuit application in our field today is in the fuel gage of an expensive current model of relatively low volume. True, this is a small volume item, but it represents a new trend. It is only a matter of time until economical printed circuit units will be perfected to replace much of the maze of wiring that now is found under the car instrument panels.

(Turn to page 128, please)



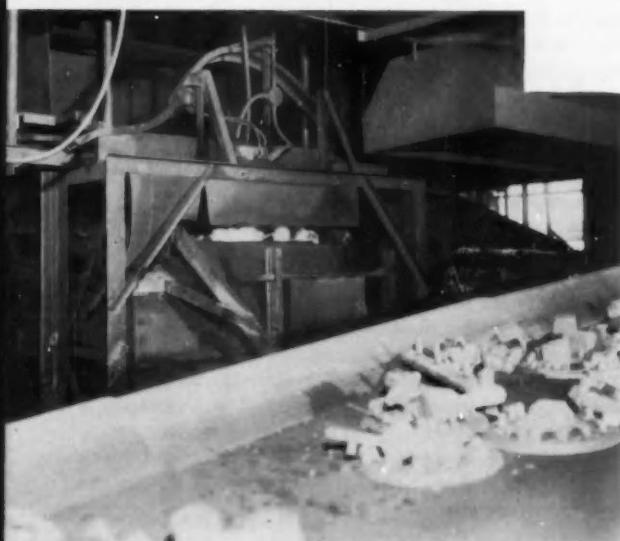
A portion of the Jervis B. Webb pallet type conveyor as it traverses the pouring station.

Picture above right shows the Lectromelt furnace in which the metal is prepared for pouring on the two lines described in the article.



**S**EVERAL distinctive conveyor systems installed in the foundry of the Bendix Lake Shore plant on the outskirts of St. Joseph, Mich., contribute importantly to smoother operation and improved flow of work, accompanied by the elimination of the usual manual handling associated with foundry operations. One of these systems is an automatically-operating pallet-type conveyor installed by Jervis B. Webb on

## Automatic Conveyor Systems Facilitate Foundry Operations



the squeezer molding line for small parts. The other is a compact pallet-type Link-Belt conveyor system serving the recently installed Link-Belt shell molding line. Both systems are of variable speed type.

The Jervis B. Webb conveyor line has a developed length of some 400 ft and carries 120 pallets in its circuit about the squeezer molding line. In operation, the small molds prepared on the molding machines are placed on the pallets and are transported to a 26-

**V**iew of the arrangement for raising the tray to dump the flask on the J. B. Webb conveyor. In the center near the top may be seen the formed structural member which is engaged by the roller on the tray. The flask is dumped completely when the roller reaches the top of the curved member. The entire load then drops onto the vibrator type conveyor in the foreground.

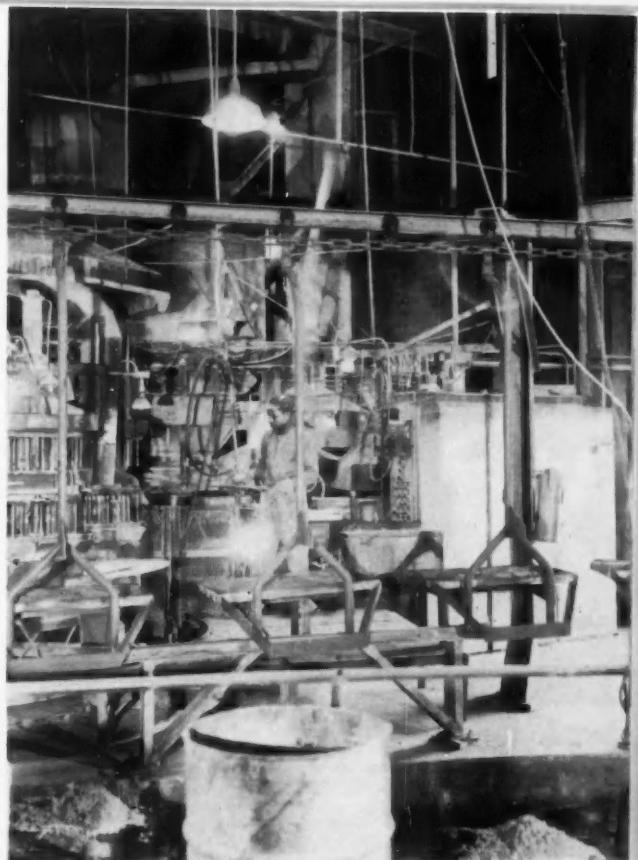
ft pouring area where the cast iron is poured from a ladle suspended on an overhead conveyor. The pallets then continue to the shakeout station. At this point, the outer edge of the hinged pallet rides over a cam-shaped rail which tilts the pallet enough to dump the mold into a chute that leads to a special vibrator-type conveyor.

A distinctive feature of this conveyor is the provision of a flipper switch on each pallet which permits the selected pallet or pallets to go through the shakeout station without engaging the cam deflector. Bendix has found that the hardness of the castings is a function of cooling time. Consequently, certain types of castings are so routed as to ride the conveyor at least one additional cycle around the circuit. The flipper switch will select the kind of cycle indicated for each type of casting.

The Link-Belt installation includes not only a pallet-type conveyor system, running some 452 ft in developed length and transporting some 113 pallets, but a special Link-Belt shell molding machine as well. In effect, it is a compact and self-contained shell molding operation fitted into the existing foundry.

As illustrated, the L-B shell molding machine is of four-station design with the stripping station in front, an investment station, and two baking stations, which divide the baking stage into two steps.

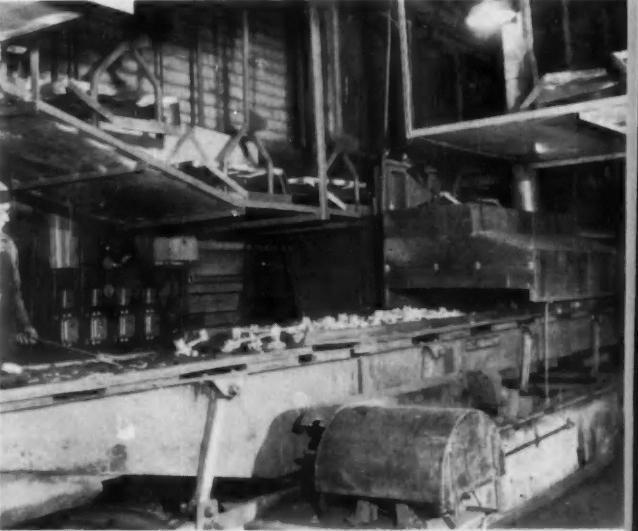
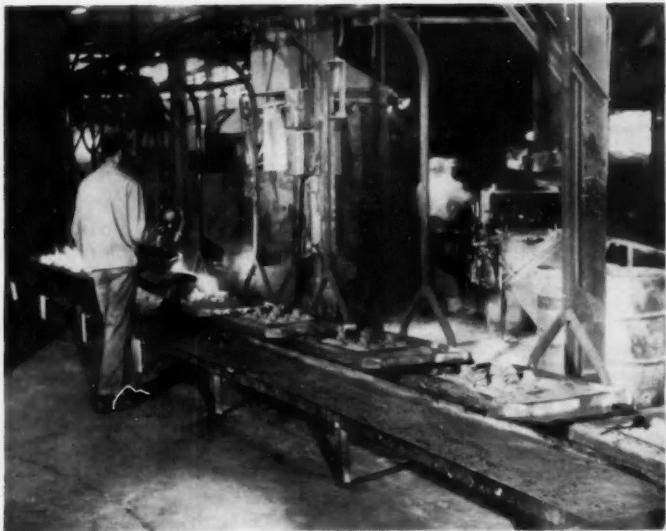
The heated mold is so designed as to produce the cope and drag of the small mold in one operation. During stripping, the operator breaks the piece into



**Link-Belt shell molding station.** The shell molding machine is in the center background. Directly in front may be seen a portion of the Link-Belt pallet type conveyor serving this line. Bonding is done in the machine at the extreme left.

**Shell molds are poured at the station seen below left.** Note how the mold is nested on a thick bed of sand which constitutes the only provision for support.

**Picture below shows shakeout on the shell molding system.** The flask is dumped automatically and its contents dropped onto the new Vibraveyor conveyor in the foreground. Just past this station the tray is filled automatically with a bed of sand for supporting the mold.





**One of the items of special new equipment in the machine shop is this multiple-way, indexing type Natco for a variety of operations on hydraulic valve bodies. In the one setting it mills the face, drills five holes, and drills one angular hole.**

its two halves. These are transferred to the adjacent machine where the special bonding material is deposited in small heaps, uniformly spaced around the mold. The two halves then are brought together, clamped firmly under pressure, to produce a well-sealed joint.

It is interesting to find that these molds are poured without any backing or support except for nesting on a thick bed of sand on the pallet.

The pouring area, directly adjacent to the shell-making operation, runs about 40 ft in length. The conveyor then transports the molds to a remotely located shakeout station where the mold is dumped off the pallet by means of a power-operated arm. The mold then proceeds down a chute to a special vibrator conveyor for shakeout. In the process, of course, the backing sand too is dumped off.

It will be noted that after the pallet leaves the shakeout station it passes by another station at which the backing sand is automatically replaced on the pallet ready for the next mold.

This foundry operation melts around 100 tons of cast iron per day, 15 tons of this being consumed in shell molding.

It is of interest that the foundry operation mentioned here serves various divisions of Bendix Aviation Corp.; also supplies special pressure castings to other customers.

## Facts About Sealed Power Cyclan Ring Iron

THE latest trend in engine design has resulted in a demand for increased horsepower output which has been obtained in various ways by different engine designers. In most instances the basic changes have been toward larger cylinder bores with over-square bore-stroke ratio, V-8, OHV engines to obtain the greater output. In some instances, after the new design V-8 was introduced into a manufacturers line, there have been modifications of the basic engine to obtain a greater output. This has been obtained by several means such as further increase in bore diameter, increased compression ratio, increased engine speed at peak output, and increased BMEP. Many manufacturers are now considering fuel injection, which may further complicate the problem; however, it could result in an improved condition as far as piston rings and ring life are concerned through better fuel distribution.

To investigate how these changes affect the operation of piston rings could become very involved. Some of these changes do involve conditions which can be detrimental to the life of the more commonly used rings and ring materials. Top rings will be sub-

jected to higher temperatures, greater pressures, greater inertia forces, resulting in rings made of present materials being subject to breakage, loss of tension and excessive side wear as well as the pounding out of ring grooves. To meet these conditions Sealed Power Corp. has developed a ring material known as Cyclan.

Cyclan has the wearing qualities of cast iron, increased tensile and impact strength and greater resistance to loss of tension from higher operating temperatures. These characteristics aid in maintaining ring stability with a general reduction in side wear on the ring and groove. Following are some actual test results:

On two different designs of test engines of the latest V-8 design, a split setup of standard cast iron and cyclan top compression rings, all chrome plated on the outer periphery, were installed. The engines were installed in vehicles and operated for a total of 50,000 miles. Upon completion of the tests and disassembly of the engines, a marked reduction in groove wear was observed where the Cyclan rings were installed. The groove wear experienced with the cast iron rings was 0.008-0.010 in. as com-

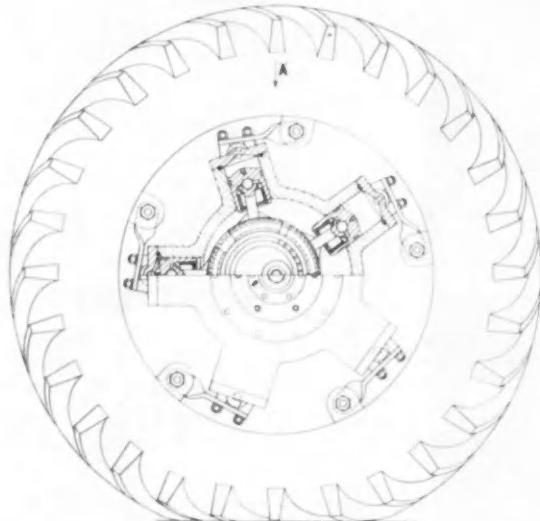
pared with 0.0021 in. on the sides of the piston grooves which contained the Cyclan rings. Similar results were observed in comparison of steel rings with Cyclan under identical test conditions. The grooves with the steel rings averaged 0.011 in. wear as compared with 0.0029 in. wear in the grooves with the Cyclan rings. While these figures are quite similar to those experienced in the comparison of cast iron with Cyclan, a very decided difference in ring side wear was noted. The side wear on the steel rings was 0.0165 in. as compared with 0.0025 in. on the Cyclan ring.

Ring breakage, in most cases, can be traced to increased side clearance between the ring and ring groove. The Cyclan ring prevents breakage in two ways. First, by its superior wearing qualities which prevent excessive side wear as exhibited in tests cited above, and secondly, by its high modulus and impact strength which allows the ring to deflect without damage after excessive side clearance occurs. To confirm the second point, a split set-up of standard cast iron and Cyclan rings was installed in a V-8 overhead valve engine hav-

(Turn to page 124, please)

# Hydrostatic Transmission for Tractors

*Radial motors form the spokes of the 11 x 36 drive wheels. The use of a stationary axle and internal valves avoids any high-pressure oil seals exposed to atmosphere.*



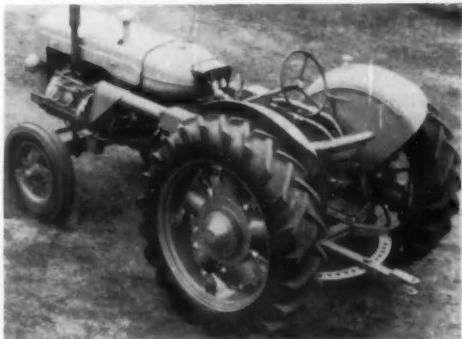
**A**n experimental tractor with full hydraulic transmission has been developed by the National Institute of Agricultural Engineering, Silsoe, Bedfordshire, England. A feature of the design is flexibility of mechanical layout, and it is believed that the research and experience on this project are of value for many types of slow-moving vehicles.

The variable-delivery pump, driven by the Fordson Major Diesel engine, is based on a Vickers Armstrong VSG. It consists of a rotating cylinder block with pistons linked to a ring whose degree of tilt determines the rate and direction of delivery.

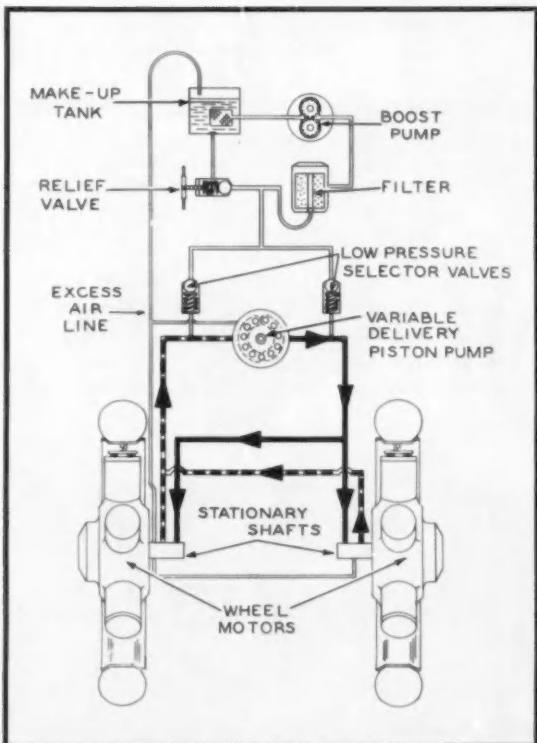
A single lever controls the angle of the tilting box, and therefore the forward and reverse speed of the tractor. In mid-way position the pump is in neutral and the wheels braked. Flow is 62.5 gpm at 1600 rpm engine speed.

Individual radial motors are built into each rear wheel, the five cylinders forming the spokes. This arrangement utilizes waste space, and would simplify the steering of a driven wheel. The rotating cylinder casing is supported by bearings on a shaft mounted rigidly on the tractor frame.

An eccentric on this fixed shaft carries a large roller bearing which is externally machined and



**The variable-delivery pump is mounted on the left of the Fordson Major Diesel engine, and chain-driven from the crankshaft. External pipes on the wheel motors have been replaced by oil passages in the cylinder casting in a later design.**



**Tractor hydraulic circuit, showing the continuous flow between the central piston pump and the two wheel motors. The boost supply introduces oil into the main pipe lines in order to avoid entry of air resulting from fluid leaks.**

ground. Short columns, bearing on this surface with white-metalled pads, receive the piston thrust through a trapped ball.

During forward motion, oil reaches the cylinders  
(Turn to page 174, please)

# How Windshield Reveal Moldings are Made, Buffed, and Plated

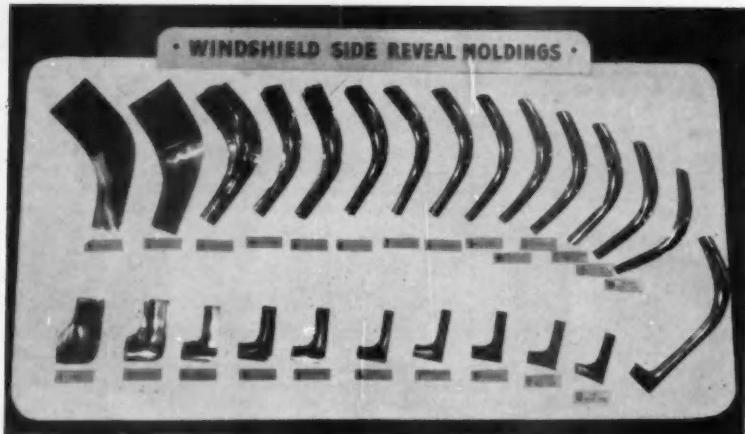


FIG. 1—Series of right hand windshield side reveal molding parts as they appear in successive stages of production and after the two are joined by welding and are plated. Similar left hand parts are produced in the same Ternstedt plant.

**M**ANUFACTURE of windshield frames for General Motors cars is among the major activities of the Corporation's

Ternstedt Division and is centered largely in a Detroit plant. This is one of the largest of GM divisions, as it also operates sizable plants in

Flint, Mich., Columbus, Ohio, and Trenton, N. J.

Windshield frames are built up from several stampings, each of

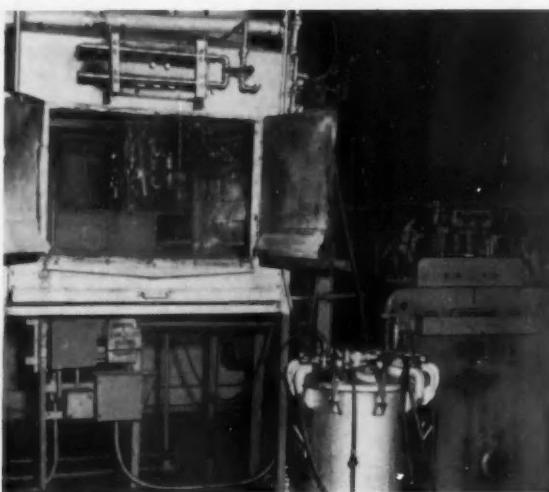


FIG. 2—Roll feed and straightener for coil stock used in making Ternstedt moldings for General Motors cars, and a booth in which a temporary plastic coating is sprayed on to minimize scratching in subsequent handling.



FIG. 3—Press and die setup for the initial draw on a blank in producing a lower section for a windshield side reveal molding. A belt in front of the press carries the stamping to the next and subsequent press operations.

which must be made, assembled and finished with great care partly because the frame becomes a prominent body component and contributes much to fine car appearance. One component of a typical windshield is called a "side reveal molding." As Fig. 1 shows, this is made from two stampings that together undergo a total of 24 operations before they are welded together. After welding, numerous finishing operations are performed on the assembly, which is only one of several in a complete windshield.

Cold rolled stock used for most windshield parts contains 0.08 to 0.13 per cent carbon but much stainless steel containing 16 to 18 per cent chromium is also employed. Before the coiled stock goes to presses, it is passed through a roll straightener. Then a temporary plastic coating is sprayed on during passage of the stock through the booth shown at left in Fig. 2. This coating is applied to minimize scratches in handling, thereby reducing greatly the polishing required before plating can be done.

Figure 3 illustrates the setup in which hand fed oiled blanks for the lower section of a side reveal molding are given their first draw to produce an L-shaped stamping in which both legs are given a U-shape section. Safety nippers are employed for both loading and unloading, after which the stamping is placed on a belt that parallels the row of presses, runs between operators and press beds and advances the workpiece to all presses in the line.

At the second station along the belt, the stamping is trimmed and then is advanced through a series of restrike dies until, after the tenth operation, the piece is ready for welding to the mating upper stamping. This upper section, also shown in Fig. 1, receives its initial draw on a press in another line and then is trimmed all around in the setup, Fig. 4, using nipper feed and ejection. Thereafter, a belt advances the stamping to a series of 11 dies in which restriking yields a piece (Fig. 1) of the required



**FIG. 4**—In this setup, the first draw operation is performed in producing an upper section of a windshield reveal molding. Subsequent press operations include trimming and restriking in other dies.



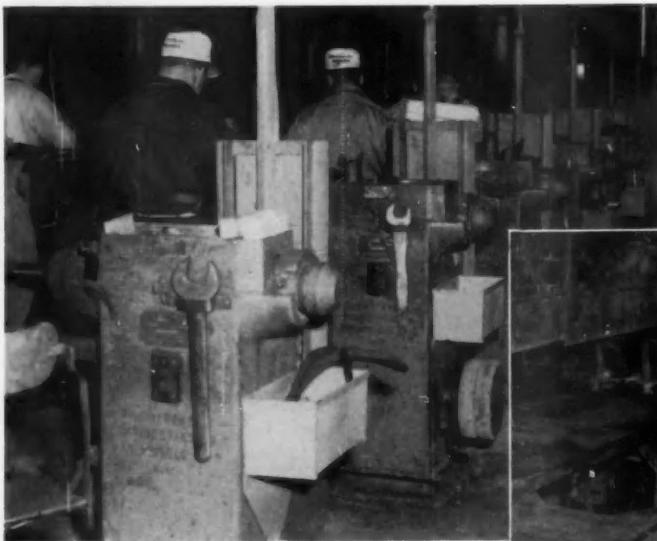
**FIG. 5**—Upper and lower sections for windshield reveal moldings are advanced on the belt, in the foreground, to this precision built welder, in which they are joined after clamping in holding dies.

size and shape for welding to the lower section.

Both parts ultimately arrive by belt at the precision butt welder, Fig. 5. There, they are clamped in dies that hold the two pieces in correct relation and press them together to effect the weld. This

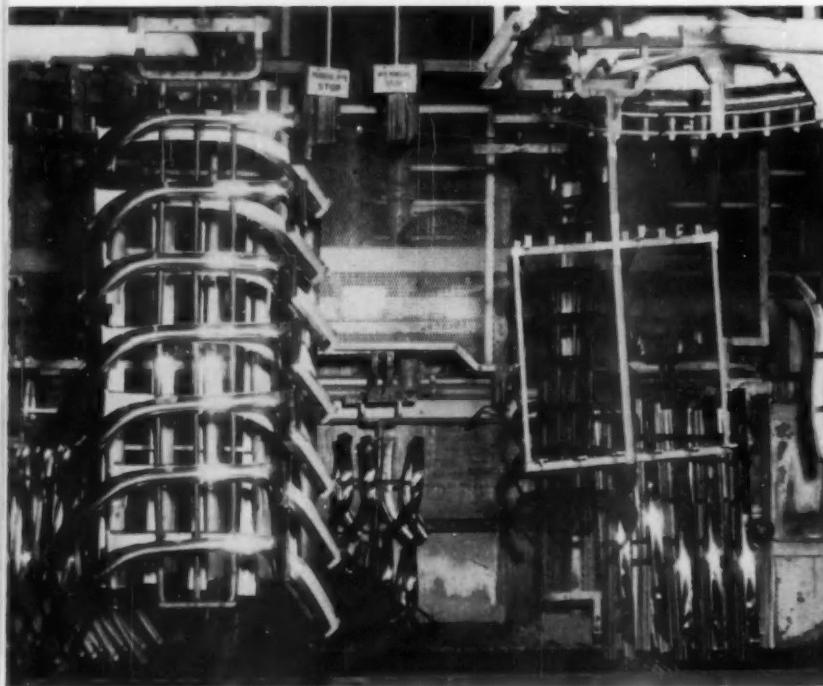
completes the stamping and welding operations on a right hand side reveal molding. A similar series of operations is required to produce corresponding left hand moldings.

Both moldings then are advanced along a line of hand polishing and buffing heads, Fig. 6, equipped with



**FIG. 6—After welding, as in Fig. 5, reveal moldings are polished and buffed while moved by hand against wheels along this line, to smooth and buff surfaces that are subsequently plated.**

**FIG. 7—Automatic brushing and buffing of reveal moldings is done in the area (below) with the parts set in fixtures whose base includes a roller chain that engages sprockets below four wheels and moves the molding so that all its upper surfaces are buffed.**



**FIG. 8—Loading and unloading area at one of the machines that does chrome plating of windshield reveal moldings as they are held on special racks. From this point, the molds go to chrome coloring and then to a packing area.**

wheels that polish welded and other surfaces and buff out scratches. Thereafter, the parts are returned to a belt and are carried to an automatic buffering area, Fig. 7. There, each piece is clamped in a fixture whose base includes a roller chain set in fixed position between curved parallel bars.

When each fixture is thus loaded, it is passed in succession under each of four wheels, the first being a Tampico brush, the second a sisal buff, the third a finger buff and the fourth a ventilated muslin buff. Motion of the fixture under the wheel is caused by a slowly rotating power driven sprocket that engages a chain in the base of the fixture. A roller opposite the sprocket holds the fixture against the sprocket.

Rotation of the sprocket not only advances the fixture and the workpiece under the wheels but causes both to move on a table in such a way that the whole workpiece upper surface contacts each wheel during the transit. While this transit proceeds, the operator loads and places another fixture. Each fixture

must be placed by hand under each of the four wheels but need not be touched again until it feeds around and disengages the sprocket.

After a fixture with its load has been passed under the four wheels in succession, the piece is unloaded and the fixture is placed on a short belt that returns it to the start of this buffering machine. All wheels turn inside an enclosure and are sprayed automatically with compound. Parts passing through this setup issue with a high polish and are free of such scratches as would be seen after plating if not removed by the processing just described. After inspection, moldings not of stainless steel are racked for copper plating.

In the conveyorized copper plating machine, the following sequence of processing is followed except that suitable rinses, not specifically mentioned, are interspersed to insure trouble-free results as well as to prevent carryover of solutions from tank to tank:

- 1—Anodic clean at 210 F.
- 2—Dilute muriatic acid dip.
- 3—Anodic clean at 210 F.
- 4—Dilute muriatic acid dip.
- 5—Copper strike plating in bath at 125 F.
- 6—Dilute sulphuric acid dip.
- 7—Bright plate in acid copper solution.

Two 10,000-amp motor generator sets supply current for acid copper plating and the plating solutions are air agitated and subjected to continuous filtration. There are also filters on the copper strike and on both anodic cleaners. Total length of this plating line is 110 ft and ampere capacity is 750 per rack. Racks measure 60 in. long, 20 in. wide and 14 in. thick, and the free plating area per rack is 8 sq ft.

Although a bright copper plate is produced, the parts are unracked and the plate is buffed before nickel plating, as buffering flows the copper sufficiently to cover such fine scratches as remain visible after the earlier polishing and buffering operation and the initial plating. Moldings are then re-racked and are put through another conveyorized plating machine in which nickel and chrome coats are applied. In this machine the following sequence of operations occurs but these operations are interspersed with thorough water rinsings not mentioned:

- 1—Soak in cleaner solution heated to 140-150 F.
- 2—Apply spray cleaner at 140-150 F.
- 3—Reverse cleaner at 160 F.
- 4—Dip in dilute citric acid.
- 5—Ronal copper plate at 140 F.

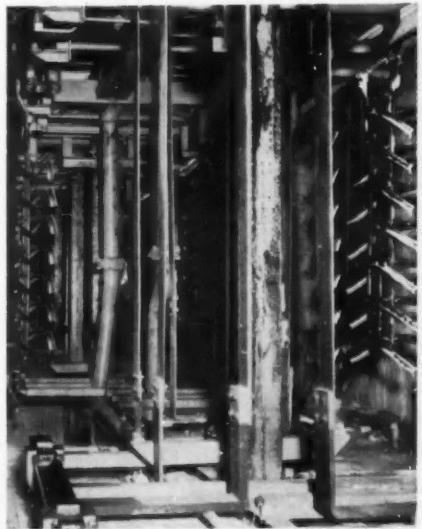


FIG. 9—Portion of the conveyorized machine on which stainless steel windshield reveal moldings are moved through cleaning, rinsing and chrome plating tanks.

6—Reverse cleaner at 160 F.

7—Dip in dilute sulphuric acid.

8—Nickel plate at 145 F.

9—Chrome plate at 100-105 F.

Cleaners, as well as the copper and nickel plating solution, are subjected to continuous filtration and the Ronal copper is in an anode diaphragmed tank with constant solution agitation. Anode bags are not needed or used in the bright

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FIG. 10—Area in which coloring is done on windshield reveal moldings that have been chrome plated. Inspection follows, on the belt that advances the finished moldings to a packing and shipping department.

# THE CYCLE RACE

By A. L. Boegehold

Manager of Research Staff Activities  
GENERAL MOTORS TECHNICAL CENTER

## An Engineering Evaluation of the Future Possibilities of the Free Piston Engine and Gas Turbine in Competition with Current Automotive Engines

How do various power plants available at present compare? Table I gives some information about such engines. Listed are piston engines of different compression ratios, gas turbines, 2-stroke cycle and 4-stroke cycle Diesel engines, one with turbo blowing, and a free piston engine. Information is given on fuel economy, weight, size, and grade of fuel.

The gas turbine, considered by many to be the coming power plant, compares well with the present day piston engine in weight and can be put in less space. We need more information on how to get along with less nickel for turbine blades. One way to eliminate the need for nickel or cobalt in turbine blades would be to maintain a low enough blade temperature. This can be done and has been done both abroad and in this country by liquid cooling. To do this, however, requires a condenser and radiator to cool the liquid used for blade cooling. This added complication would sacrifice the weight advantage in favor of the gas turbine.

A point that has to be cleared up in connection with the use of gas turbines in vehicles that must continually slow down, stop, and then accelerate again, is whether the gas coupling between the gasifier turbine and the power turbine will provide the acceleration demanded in present day passenger cars. Gas turbines can use the cheaper fuels, and those engaged in developing gas turbines are confident that the material problem will be solved, so

	Fuel Consumption Lb/bhp/hr @ Max. Power	Fuel Consumption Lb/bhp/hr @ Best Econ.	Weight Lb/hp	Size Cu.in./100hp	Fuel
Spark Ignition Piston Engine Cast Iron 9:1 Comp. Ratio	.48	.41	3.6	9.1	95 Octane
Spark Ignition Piston Engine Aluminum 12:1 Comp. Ratio	.44	.38	2.2	8.4	110 Octane
Spark Ignition Piston Engine Aluminum 8:1 Comp. Ratio Turbocharged - 30% Boost	.49	.43	2.1	7.3	95 Octane
Gas Turbine - Regenerative	.75*	.75	3.6	7.2	Kerosene
Gas Turbine - (Projected) Regenerative	.60	.60	3.0	7.2	Kerosene
Diesel Engine 4-stroke cycle	.41 - .47	.38	12.7	26.0	#2 Diesel
Diesel Engine 2-stroke cycle	.42	.40	12.1	14.8	Kerosene
Diesel Engine 2-stroke cycle Exhaust Turbo Blower	.42	.41	11.7	13.6	Kerosene
Free Piston Engine	.48	.48	3.6	7.0	Kerosene Gasoline, Diesel

TABLE I—Comparison of engine types

we must include the gas turbine as a distinct contender for a place in the race for the power plant of the future car even though its fuel appetite is on the high side. Certainly, it will find uses in certain areas such as sport cars, and possibly cargo carriers, etc.

Diesels will continue to be useful in buses and trucks, boats, and a variety of steady power units, because of the low fuel consumption without requiring a premium fuel. The Diesel engine's heavier construction is the result of designing to achieve durability in a type of operation typical of trucks and buses in which a much greater percentage of time is at near full power output than is called for from passenger car engines. The use of turbo blowing increases both power output and fuel efficiency and the use of aluminum in numerous parts will make a substantial reduction in weight per horsepower and will decrease unit size.

An aluminum engine would weigh about seven pounds per horsepower. Even this would not be suitable for passenger cars. It is possible to design a Diesel engine of lighter construction for passenger

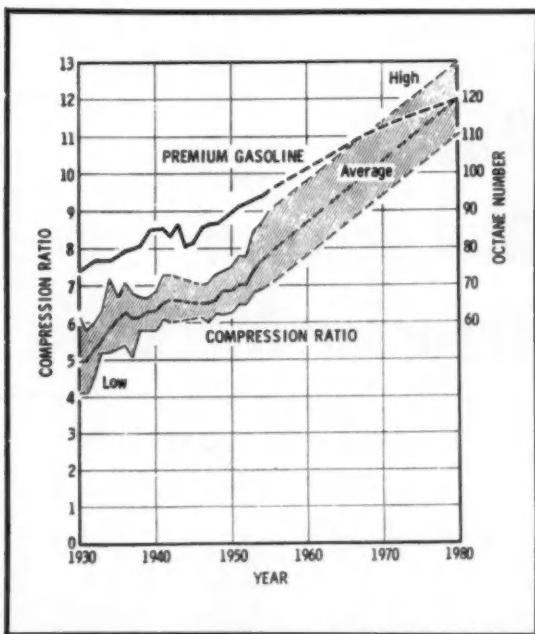


FIG. 1—Trends in compression ratio and octane rating—  
1930 to 1980

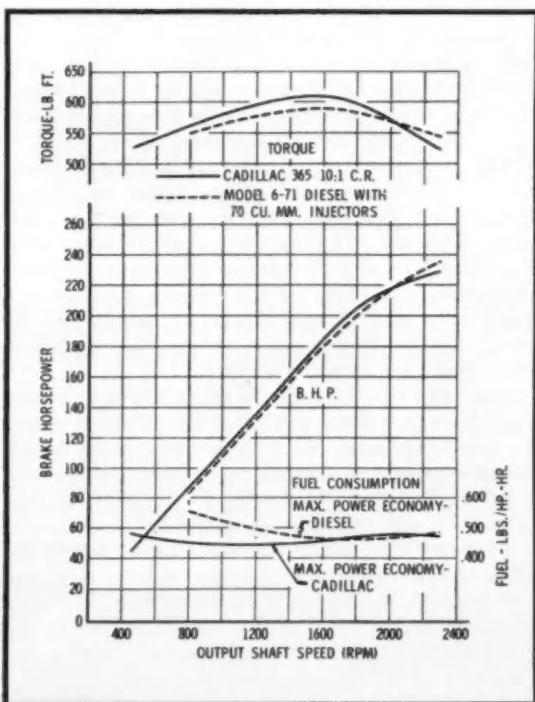


FIG. 2—Comparison of gasoline engine with Diesel engine

car use, but we do not anticipate development in this direction.

The free piston engine may experience a rapid climb to favor because of the fact that it can operate on almost any kind of liquid fuel, it is economical to

build, and has fuel economy nearly as good as the Diesel engine. The free piston engine may be strong competition for the spark ignition piston engine passenger vehicles 25 years hence.

A principal advantage in favor of the free piston engine is that it burns low grade fuels such as kerosene or mixtures of Bunker C and kerosene. The necessity for heating Bunker C rules it out as fuel to be used by itself for this unit in a passenger car. If free piston engines ever become the universally used power plant for passenger cars, the output of the petroleum industry would undergo a radical change to supply lower grade fuel in much larger quantities. The competition for use in the field of cargo carrying vehicles where durability and fuel consumption are important, will include the turbo-blown Diesel, the free piston engine-turbine combination, the regenerative gas turbine, and the high compression gasoline piston engine made more rugged to stand steady high output operation.

How does the gasoline piston engine stack up against the gas turbine and the free piston engine in the race for acceptance as the powerplant for

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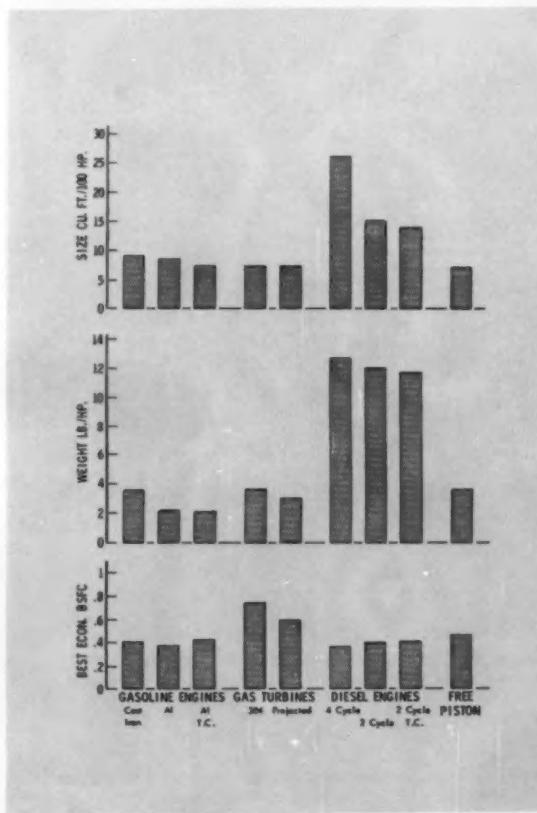
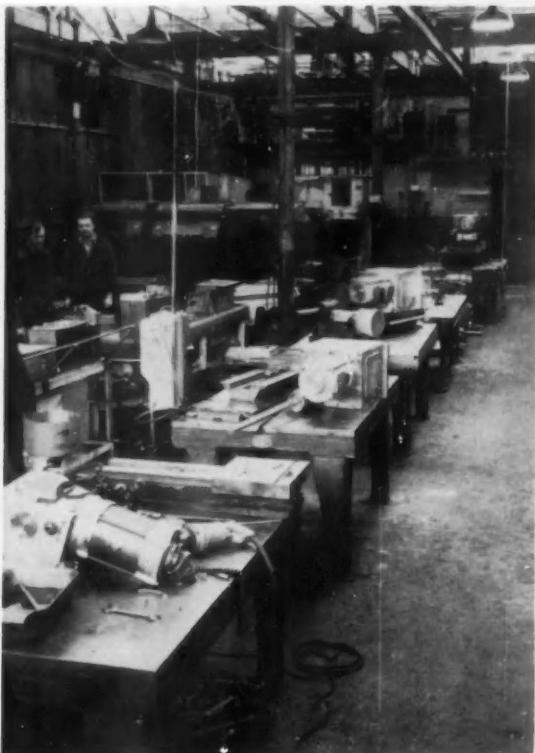


FIG. 3—Comparison of engine types



Top picture shows the standard unit heads built in the machine shop consisting of a drive motor and spindle box saddled on a base slide which carries the fast-feed motor. Mechanical feed is by a leadscrew. The test rig is shown in the background.

Bottom picture shows the loading end of the 32-station plate-type transfer machine for four-cylinder engine blocks. It comprises 51 standard heads with a total of 167 work spindles. Center bed sections, supplied by Archdale, are in lengths of two or three sections bolted together.

# Austin Makes Own Transfer Machines

BY DAVID SCOTT

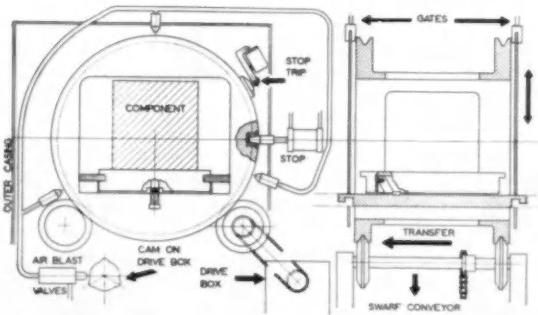
AUSTIN'S factory at Longbridge, near Birmingham, England, has become one of the most highly automated plants in Europe on the basis of building its own high-output machining equipment. The decision to make transfer machines instead of purchasing them was prompted by several considerations. To begin with, no British machine tool manufacturer was prepared to build equipment of this type in the quantities required. Initial estimates showed that suitable machinery could be produced more cheaply than by buying from foreign suppliers, or by purchasing single British machines and linking them up with automation.

With this as a starting point, a program to make standard machining units at Longbridge was begun several years ago. An agreement was reached with James Archdale & Co. whereby they would provide the center beds and the loading and unloading ends complete with transfer drive units, and Austin would produce the rest. It was decided to standardize on three basic sizes of unit heads which could be adapted for drilling, boring and milling.

These could be mass-produced at low cost, would simplify maintenance and stocking of spare parts, and would facilitate rapid replacement of an entire assembly in case of breakdown. Another advantage would be flexibility of layout of the transfer line when it became necessary to retool for a new component. And the same units could be used for rotary indexing automatics.

A special shop employing about 50 men was then set up, where production of standard components permitted extensive use of jigs, fixtures and single-purpose tools for machining. Capital outlay in the past six years has reached the equivalent of \$200,000, and during this period a total of 3000 unit heads have been built for both transfer and rotary machines. According to F. Griffiths, chief production planning engineer at Austin, this equipment has been made at approximately one-fourth the cost, in England, of comparable machinery.

The standard unit heads consist of base slide, saddle, and two electric motors with appropriate



Platens on transfer machines are kept clear of chips, etc., by a special enclosed station in the line. Sliding gates drop over the platen, fixture and component, after which the assembly rotates while air jets blow chips into the conveyor running beneath the center beds.

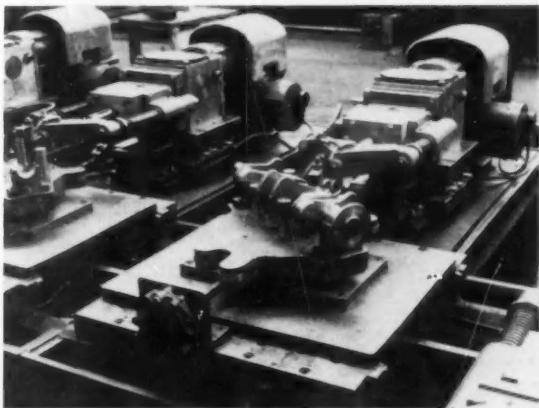
gearing. Travel is by a leadscrew, mechanical drive being universally adopted partly because it is necessary for tapping operations. The head motor drives the work spindle and the leadscrew for slow feeds. The fast-feed motor, mounted on the base, rotates the nut that locates the leadscrew under cutting conditions. A series of limit switches on the side of the main slide controls changes from fast to slow feed and reversals.

The 400-volt a-c motors now employed have built-in clutch and brake mechanisms, and the latest machines use 50 volts d-c on the control circuits. The units are entirely self-contained, and can be adapted to a variety of tooling, including multi-spindle. Their cost is stated to range from about \$500 to \$1150, depending on size and stroke.

Branch beds are also of standardized design, in four-, five- and six-foot lengths, bolted to the machined side faces of the center beds. For vertical positioning of the head, a standard column is mounted on the branch bed. Balancing is done pneumatically by means of a compression bottle and air

**Unloading end of the 32-station machine for engine blocks.**  
Three sizes of standard heads are used, and all have mechanical feed by means of leadscrews. Heads are counterbalanced by air cylinders connected to compression tanks.  
Branch beds and columns are also standardized.

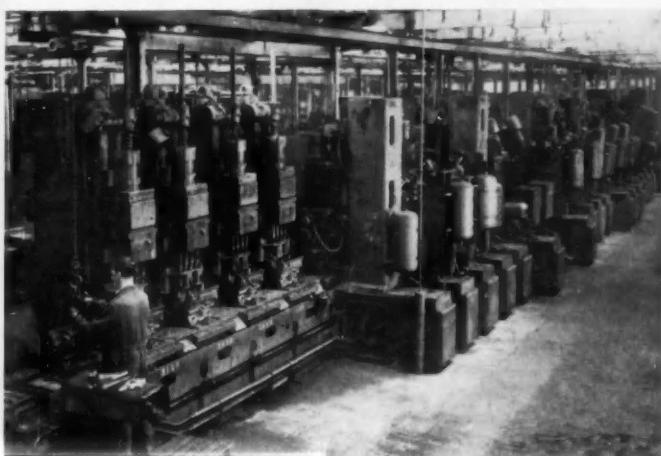
On the 14-station transfer lines for crankshafts, the platens and fixtures index 30 deg each side of normal for drilling of the oil holes. Cycle time is 1 min. 40 sec.



cylinder, the piston of the latter being linked to the sliding head by a roller chain passed over pulleys. Air pressure is adjusted according to the weight of the head, which enables the column to be balanced rapidly during installation regardless of its angle.

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**The 17-station line for aluminum gearbox casings seen from the unloading end.** The plates-lowering mechanism is in the foreground, and the platen-return conveyor passes under the branch beds back to the head of the line. The chip conveyor is at the extreme right.



# New Uses For

TABLE I

## Distribution of Weight of Magnesium in Components

Component	Number of Castings	Weight of Component (lb)
Steering column shrouds (2), socket and cap .....	4	1.388
Oil seal.....	1	0.227
Window bracket assembly.....	5	3.538
Power steering unit reservoir cover.....	1	0.250
Fuel pump housing.....	2	0.534
Signal switch mounting plate.....	1	0.070
Fan spacer.....	1	0.154
Steering column bracket assembly and cap .....	3	0.822
Total.....	18	6.981 lb

TABLE II

## Comparison of Die Cast Metal Costs for Finished Castings

	Zinc Hot Chamber	Aluminum Cold Chamber	Magnesium Hot Chamber <sup>a</sup>
ASTM alloy.....	XHII	SC84	AZ91B
Price delivered (\$/lb).....	0.175	0.305	0.310
\$100 buys (lb).....	571	328	322
Av. metal loss (\$ or %).....	2	5	12
Av. metal loss (lb).....	11	16	39
Casting to sell (lb).....	560	312	283
Alloy density (lb/cu in.).....	0.24	0.098	2.068
Wt of 10 cu in. casting (lb).....	2.4	0.98	0.66
Castings to sell (units).....	238	318	429
Over-all metal cost (\$/casting).....	0.43	0.315	0.23

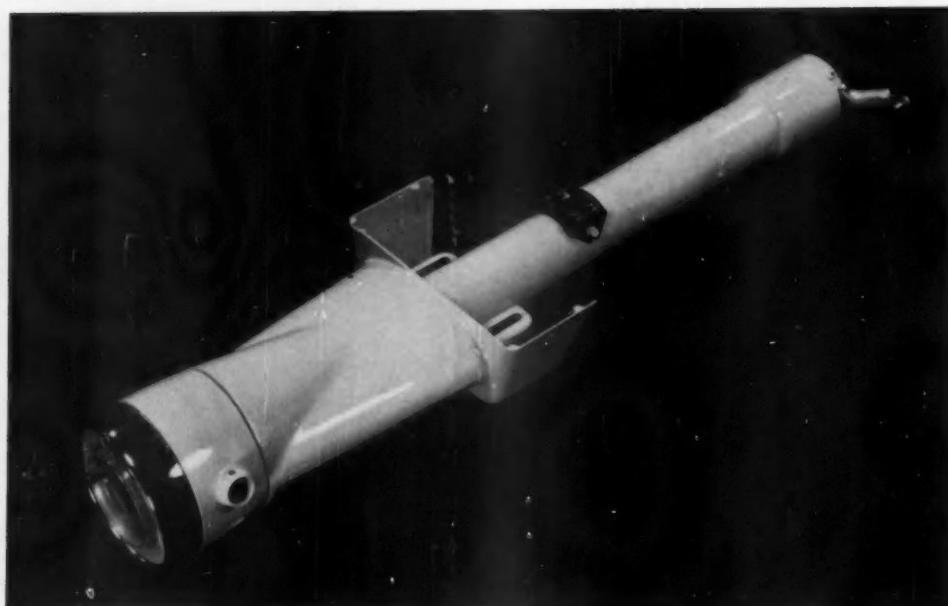
WITH the addition of such components as power brakes, power steering, air conditioning, and other "extras," automobile makers are forced to search for methods of lightening other components so as to keep the total load from becoming too high. Otherwise, supporting members of the car (suspension system and tires) must be increased in size and weight to carry the load.

The urgent need for a metal that is light as well as price competitive has resulted in an increase in the use of magnesium die castings, which was made possible largely by the development of the hot chamber process for magnesium in 1954. Besides being light, magnesium has excellent machining characteristics: it can be machined at very high speeds and is easy on tools—both assets in automation.

One large automotive parts supplier is installing magnesium hot chamber machines in his own plant. About 15 other metalworking companies, some of them job shops for passenger car makers, plan to install these machines.

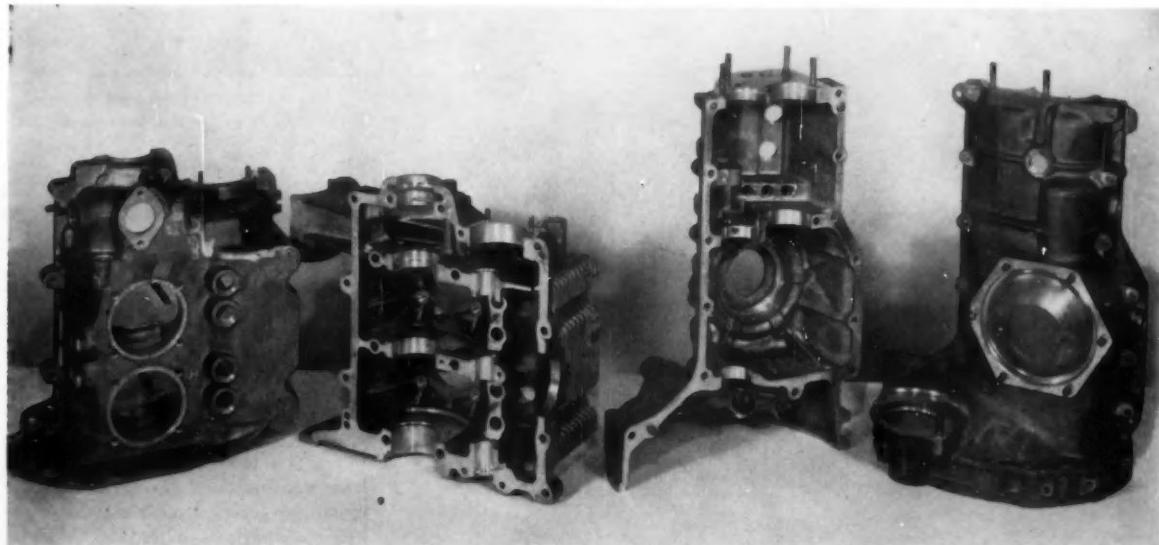
According to the Dow Chemical Co., magnesium hot chamber die castings are currently used in eight separate automobile components, comprising 18 separate magnesium castings. Total weight of the components is about seven pounds. Table I shows distribution.

Except in the case of the fan spacer, an original magnesium part, magnesium has been substituted for



Steering column shroud, socket, and cap

# Magnesium Die Castings



**Magnesium castings used in engine of the German Volkswagen. Transmission halves (right) are cast in cold chamber die casting machines; crankcase halves (left) are cast in permanent molds.**

other metals in these components and on an equal volume basis. Since magnesium is lighter than any other structural metal, corresponding weight reductions have been achieved.

Besides weight reduction, magnesium has the advantages of reduced cost and simplified design. In the case of the power steering unit reservoir cover, for example, a single magnesium die casting replaces four steel stampings. In the old design, the lettering was

put on with a silk screening operation; in the new design, the lettering is part of the die and is cast on the part as raised letters.

The cost savings is due to two factors: (1) the magnesium hot chamber process is about twice as fast as the zinc hot chamber process, and approximately twice as fast as the aluminum cold chamber process, and (2) the cost of the raw metal is lower. Table II compares die casting metal costs for finished castings

• • •

## **May Jeep Sales Up 13% Ahead Of April**

The Willys Jeep continues to enjoy healthy sales. A marked upswing in sales in the latter part of May brought total sales for that month to about 13 per cent ahead of April.

## **Lear's New Plant To Augment Present Facility In Michigan**

A 169,000 sq ft manufacturing plant will be built by Lear, Inc., in Grand Rapids, Mich. Estimated to cost about \$3.5 million, the plant will augment present Lear facilities in Grand Rapids and permit the com-

pany to increase its engineering and research work on electronic systems for aircraft.

## **\$5.5 Million Expansion Planned By Le Roi Div.**

Le Roi Div. of Westinghouse Air Brake Co. will spend \$5.5 million in the next five years to expand engineering and research facilities. The firm already has spent in the neighborhood of \$500,000 to enlarge and reorganize its Engineering Dept. In addition, the market analysis and planning committee staff also has been expanded.

## **Continental Output Nears Original Expected Volume**

Although production schedules for the Continental Mark II have been adjusted downward several times during the year, total output for the year is expected to be near the 2500-unit volume anticipated at the outset of production. Through May 31, 2201 units had been turned out.

## **Automatic Transmissions Grow In Popularity for Taxicab Use**

Greater use of automatic transmissions by taxicab companies is indicated in a report from Dodge Div.

# *Cost of Automobile Parts Reduced*

*with*

## **PREMIX-MOLDED POLYESTER RESINS**



Some of the many parts being fabricated by Woodall from the sisal-and-glass-fiber premixes. Section thickness range from about 0.1 to 0.4 in.

RECENT developments in production techniques and lower-cost starting materials have opened new possibilities for premix-molded polyester parts to compete on a favorable cost basis with assemblies fabricated from steel stampings. The premixed molding compound contains the resin, filler, reinforcing fiber, and other ingredients combined into a single, putty-like material. It can be molded into virtually any shape using conventional compression molding

techniques. Woodall Industries of Detroit pioneered in the development of the premix molding process for reinforced polyester parts to meet the low-cost requirements of the automobile industry. Close to 4 million parts are already in automotive applications, and their variety and number are expanding rapidly.

Molding with premixes is not an innovation to the plastics industry. Premixes have been used for some time to produce parts for certain types of electrical and mechanical applications. The technique offers several basic advantages over conventional molding processes: lower material costs, less waste, less handling time and higher production rates. Economies in material costs are realized because premixes use chopped fiber reinforcement rather than mat or woven cloth. Preforms and die-cut blanks of mat are eliminated. The die is loaded in one operation, thus eliminating the time for lay-up of the reinforcing material and handling the liquid resin in separate steps. The molding charge can be precisely weighed out for the application, thus reducing flash and trimming waste. Relatively complex parts containing slots, grooves, holes or bosses, can be molded in with no special preparation.

Despite the production advantages of premix molding, the cost differential between premix molding and fabricated metal parts has not, until recently, been attractive enough to induce widespread applications in the automotive industry. Now, however, recent developments by Woodall Industries have made premix molding practical for the industry's requirements. The new interest is due to the development of a new premix containing chopped sisal fiber, which costs about one-third as much as glass fiber. This starting material, plus Woodall's large scale operations, have swung the economies in favor of the process. Such varied parts as housings for automobile heaters and defrosters, air

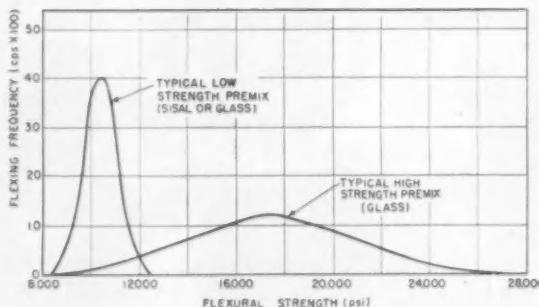


FIG. 1—Distribution of flexural strength within 12-in. square, 1/8-in. thick test panels molded with two types of polyester premixes

## WOODALL FORMADALL PREMIX MOLDING COMPOUND

PROPERTY	TEST METHOD	NUMBER 50 (SISAL-REINFORCED)
Specific Gravity at 73 F.	D 792-50	1.64 ± .02
Hardness, Rockwell "M" Scale	D 785-51	40-60
Water Absorption, % 24 hours ( $\frac{1}{8} \times 1 \times 3$ sawn specimen) ( $\frac{1}{8} \times 1.5 \times 2$ molded specimen)	D 570-42	1.3-1.7 1.4-1.5
Flexural Strength, psi, Average Range	D 790-42 T	7,200* (Specimens cut fr. $\frac{1}{8} \times 12 \times 12$ " panel) 5,200-9,100 (note one)
Flexural Strength, psi, Average Range		10,650 8,600-11,000 (ASTM Test Bar, Note two)
Modulus of Elasticity, psi, Average Range (in Flexure) $\times 10^6$	D 790-48 T	0.85 0.75-0.95
Impact Strength, Izod, Ft. Lbs Unnotched/inches of width Average Range	D 256-47 T	2.8 1.8-3.5
Heat Distortion, 264 psi, F.	D 648-45 T	Above 350 F.
Thermal Conductivity "K" Btu's/sq/in./hr./F.		1.8 Determined on slab $\frac{1}{2} \times 12 \times 12$ in.

Note One: This data is more representative of values obtained when testing specimens cut from molded parts.  
Note Two: Test Bar results are generally higher because of method of charging mold and flow which produces fiber orientation.

\* Flex values obtained from specimen  $\frac{1}{8} \times 1.5 \times 8$ , 4 in. span, cross-head rate 2.5 ipm. Similar values have been obtained on  $\frac{1}{8} \times \frac{1}{2} \times 3$ ,  $\frac{1}{8} \times 1 \times 3$ ,  $\frac{1}{4} \times \frac{1}{2} \times 8$ , 2 inch and 4 in. spans and requisite ASTM rates.

TABLE I  
Properties of one of several Polyester Premix Molding Compounds.

ducts, defroster nozzles, arm rests and kick and scuff panels are now being produced by premix molding.

The sisal-reinforced molding compound is used for parts where high structural strength is not required. Molded premixes may have lower strength than the cloth- or mat-reinforced moldings. In addition, strength may not be uniform throughout an individual piece, although in every part it is entirely adequate for the intended application. Figure 1 illustrates the varying distribution of flexural strength in test pieces molded from typical standard and increased strength sisal-polyester formulations. Table I lists other characteristics. Compared with the glass fiber premix, the sisal-reinforced material weighs less, has less strength, and is slightly less resistant to water absorption and weathering. Where higher strength and lower water absorption are important the glass fiber premix will still be used. But where these limitations can be accepted, the sisal-reinforced material offers the counterbalancing advantage of lower costs. In addition, formulations can be varied to enhance specific properties, such as low moisture absorption, high heat resistance, good electrical properties, improved strength, high surface finishes, reduced flow and curing times, and material costs. The premix can be pigmented or used in its natural color. Finished parts can be spray-painted if desired.

The steps in producing parts by premix molding are as follows:

1. The lower of two heated matched-metal dies is loaded with one or several chunks of premix. The shape and placement of the premix are designed to assure good distribution of the material.

2. The press is closed with enough pressure to squeeze the molding compound uniformly throughout the die cavity.
3. The part is left in the press for a predetermined curing cycle, which is usually less than a minute.
4. The formed part is removed from the press, usually while still hot, and then placed on a fixture to cool.
5. After cooling and inspection, the part is subjected to any necessary finishing operations and may be fitted to a sub-assembly.

Molding pressures should be kept as low as possible consistent with uniform distribution of the molding compound. Pressures range from 50 psi for simple parts to maximum of 800 psi, the average being 200-300 psi. The pressure required is in part determined by the flow characteristics of the specific molding compound and the distance the material must flow.

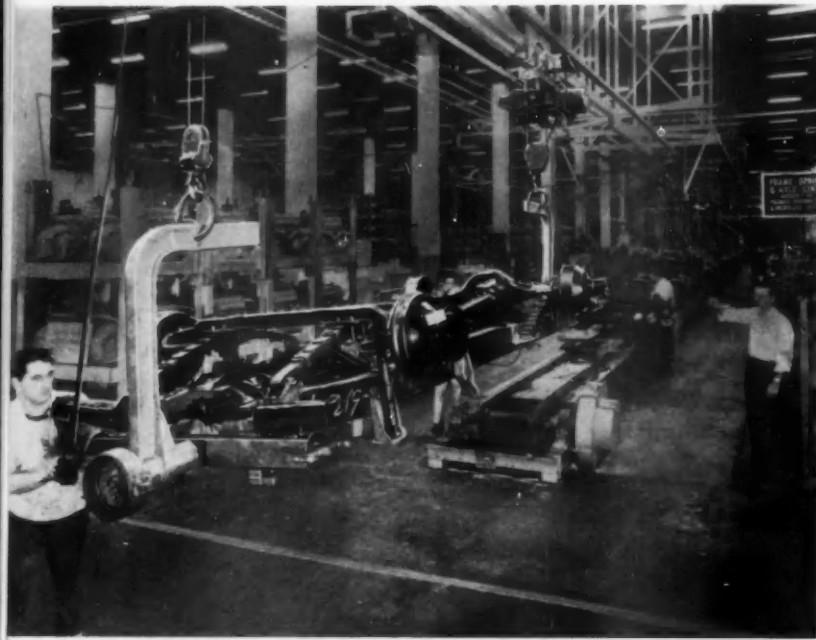
Molding temperatures range from 200-350 F, with the optimum range for high-volume production about 290-320 F. Curing times range from  $\frac{1}{2}$  to 2 min. at about 300 F; as  $\frac{1}{8}$  in. thick section will require about  $\frac{3}{4}$  to 1 min. Production rates can range as high as 40 to 50 units an hour for simple pieces.

Not all polyester resins are suitable for premix formulation. A basic requirement is that the resin viscosity remain high enough to resist flowing away from the fiber when the heated dies close.

Woodall is currently obtaining the polyester resins from several sources, including Rohm & Haas Co., and Barrett Division of Allied Chemical & Dye Corp. For fillers, asbestos, calcium carbonate or aluminum silicate

(Turn to page 150, please)

# Chevrolet's Willow Run Plant



Initial chassis assembly line in center. Here the chassis frame is handled up-side-down on the Planet floor conveyor to facilitate installation of axles and springs. In the foreground a chassis is seen hoisted on the craneway leading to the Planet chassis assembly conveyor to the left (out of this view). While hoisted the chassis is turned over to normal position.

Seen here is the installation of the heaviest powerplant offered by Chevrolet this year—the Loadmaster engine and PowerMatic transmission, weighing around 1000 lb for the assembly.



**C**HVEROLET is producing some 21 models with 250 basic items of optional equipment in its custom-built line of 2½-ton, heavy-duty truck chassis, including bus chassis, in the 500,000-sq ft facility at Willow Run. Some impression of the scope of this operation may be gained from the fact that the chassis variations include 12 different frames, eight types of rear axles—including the jumbo-sized tandem drive and 85 variations in propeller shaft lengths.

The operation begins with frame assembly, frames being built up of massive side rails and cross members on a group of riveting bucks, the rivets being made up by cold squeezing with overhead-mounted hydraulic squeezers. The operation is noiseless and free from the usual distractions. As the frames are completed they are transferred in up-side-down position onto a Planet floor conveyor for the installation of the various chassis components. At the end of the first section, following installation of chassis springs and axles, the frame is flipped over while riding on the hoistway and is dropped onto a longer Planet floor conveyor system for succeeding assembly operations.

While the chassis is moving through succession of assembly stages on the conveyor, there is a parallel activity in other sections of the plant in the painting of sheet metal and the assembly and painting of cabs. It may be noted at this point that after the engine and transmission assembly have been installed, the chassis moves through a Peters-Dalton spray booth built on the line where the entire chassis is sprayed in standard color.

Sheet metal for cab assemblies is received from the Chevrolet Cleveland stamping plant and the various sub-assemblies prepared progressively in welding bucks. The

By  
Joseph  
Geschelin

# Assembles 21 Truck Models

sub-assemblies then are brought together in a massive framing fixture where they are spot welded to form the cab assembly proper. As cabs are removed from the welding fixture they are mounted and fastened on carts riding on the chain-type floor conveyor and proceed to the body-in-white line for detail welding operations, installation of the roof panel, soldering, grinding, fitting of doors, etc.

As cabs reach the end of the body-in-white line they are transferred to an overhead conveyor which transports them through a four-stage Schmieg washer. Leaving the washer, cabs move upward on the conveyor through a drying oven mounted from the high ceiling.

Still suspended on the same monorail conveyor, cabs enter a Newcomb-Detroit prime paint booth, then continue upward on the conveyor for transport through a long drying oven reaching up through the roof.

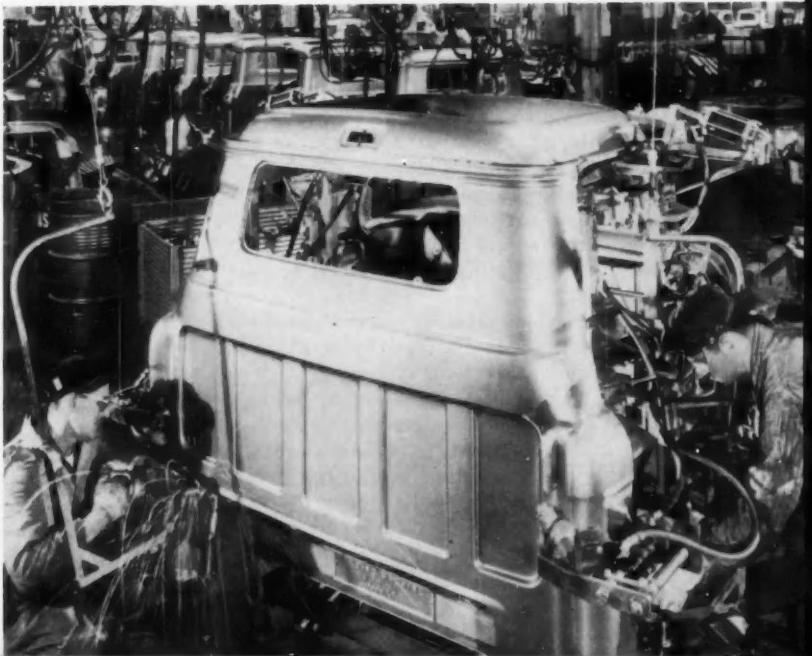
After drying, the cabs return to the floor area and enter one of two Newcomb-Detroit color booths for finish painting. An interesting feature of these color booths is that each one divides into two parallel drying oven lines, cabs being shunted from the color line to one or the other of the oven lines. This is done, obviously, to provide for the extra drying time required without increasing the length of the oven section.

Altogether the plant has seven modern, water-wash type spray booths, each one paired with a drying oven, some of this equipment being supplied by B & S Fabricators and by R. C. Mahon, the latter supplying equipment for the Flo-coat installation, in addition to other ovens. Meanwhile, the various items of sheet metal such as fenders, hoods, and other parts are



As the chassis proceeds along the final assembly line, the finished cab is dropped in place as shown.

One of the framing fixtures on the cab line, using portable resistance welders for integrating the major sections.



**RIGHT—**

Sub - assemblies are built up directly along the assembly line at points of installation. The front end sheet metal assembly is typical example. A portion of the final assembly floor conveyor line may be seen directly in the background.

**BELLOW—**

Drying of touch-up paint prior to acceptance of a finished truck is done in this infrared booth, equipped with some 300 lamps.



washed and Bonderized in a seven-stage machine, then proceed to a 50-nozzle Flocoat system mounted on the roof to provide the prime coat. Moving on an overhead conveyor line, the parts progress to a drain section, then through drying ovens, and finally to the color spray booths and drying ovens on the main floor.

Returning to the cab line, it will be noted that after the completion of painting operations, cabs are transferred onto a floor conveyor for detail assembly stages—installation of wiring, instrument panels, gas tanks, etc. At the end of this line, cabs are picked up by hoist and transferred to the drop on the chassis assembly line. This is then followed by installation of the hood and front end sheet metal.

By this time the chassis is riding on its tires and is ready to roll off the assembly line under its own power. Final operation is inspection on the "road and roll" equipment to simulate an outdoor road test.

As the foregoing sketchy account indicates, the plant is completely mechanized by means of an impressive network of conveyor systems of various kinds. This can be more readily visualized by the tabulation of major conveyor systems reproduced here. It may be noted in this connection that Allied Steel & Conveyor supplied some of the overhead conveyors noted; while General Conveyors Corp. supplied some of the overhead conveyors and floor conveyors as well.



#### MAJOR CONVEYOR SYSTEMS IN PLANT

Conveyor Function	Type	Length (Ft)
Frame Transfer	Chain	35
Frame Spraying and Axle Line	Chain	216
Fender Axle Conveyor	Floor-type (knife edge)	55
Chassis Line	Floor-type (knife edge)	387
Front End Assembly Line	Floor (flat top)	414
Cab Build Line	Floor (chain)	446
Cab Deluxe Spray Booth	Floor (chain)	55
Cab Deluxe Oven	Floor (chain)	150
Panel Deluxe Spray Booth	Floor (chain)	55
Panel Deluxe Oven	Floor (chain)	150
Two-tonne Return	Floor (chain)	153
Cab Trim Line	Floor (chain)	302
Paint Repair Line	Floor (flat top)	336
Cab Wash and Prime	All Overhead Chain Type	1,410
Sheet Metal Wash and Flocoat	All Overhead Chain Type	2,560
Sheet Metal Sulux Paint	All Overhead Chain Type	1,275
Wheel DuLux Paint	All Overhead Chain Type	865
Motor Assembly and Delivery	All Overhead Chain Type	468
Sheet Metal Storage and Delivery	All Overhead Chain Type	794

**G**EAR engineering poses one of the great problems facing the aviation industry today.

Gearing in modern aviation falls into four groups: (1) power plant and accessory drives; (2) actuators; (3) rockets and missiles; (4) radar and instrumentation. The last three groups fall into the general category of guidance. Some guidance equipment is airborne; some is ground-based, as in radio or radar direction control.

As speeds increase it will be difficult to control high performance aircraft with present methods. Supersonic speeds require that control surfaces move only minutely. Clearly then, the pilot will need assistance if he is to retain proper control of his machine.

At Convair it is expected that gears will play an important part in this equipment. These will be gears that not only transmit force, but also will accurately measure angular position, operate without backlash at high temperatures with no lubrication and under conditions of high vibration and shock loads.

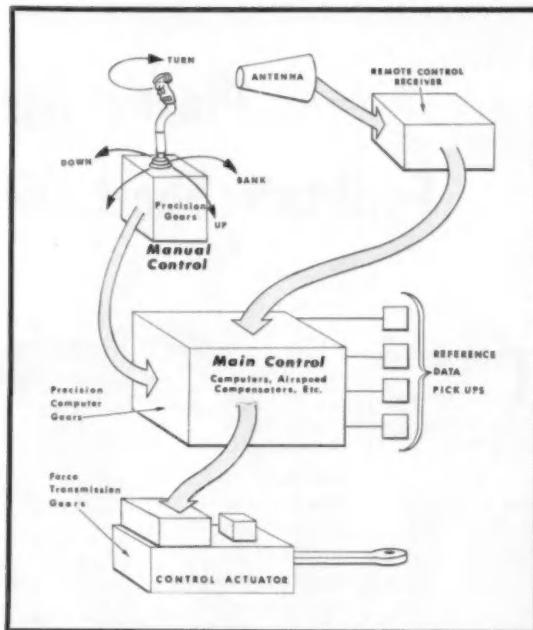
The advent of supersonic aircraft, along with new missile developments, has forced Convair into many new fields. The whole industry is in the forefront of a rapidly-expanding technological tidal wave. This wave has produced special problems in aerodynamics, thermodynamics, dynamics, structures, and controls. These problems, which can be solved only by giant computer facilities, have forced the aircraft industry into the computer business. This, in turn, has made necessary staffs of specialists to engineer, build, and maintain these computers. In addition, missile guidance and control problems have brought about feverish activity in servomechanisms, electronics, and radar, all with special problems dependent on satisfactory gearing to accomplish their goals.

Equipment on the drawing boards today requires accuracies of angular motion that can be supplied only by precision Class 3 gears. The electronic components of this equipment have errors of linearity that, for the most part, relieve the pressure for gears better than precision Class 3. In instances where greater accuracy is required and, where the rotary motion is limited, steel drive bands have been used.

The resolvers and potentiometers used in computers and indicating servos supply voltages that vary with rotation of their shafts. These voltages are used in complex servo systems which also contain additional resolvers and potentiometers. The end result is the quick performance of intricate computations.

Gearing is used to rotate the shafts of these components, usually, with a prescribed ratio relationship. It is important that this relationship does not change, otherwise errors will result. To obtain the desired accuracy requires not only the elimination of backlash, but also the elimination of all non-linearities of angular motion transmitted by the gears.

The final data obtained from these computing  
(Turn to page 73, please)



Schematic of a possible future control system for a high performance aircraft

## PRESENT and PROJECTED Airframe Control Gearing Requirements

BY

R. W. WEBER

Ass't Design Group Engineer

Convair (San Diego) Division of General Dynamics Corp.

Class of Gear	Total Composite Error, in.	Tooth-to-Tooth Composite Error, in.
Commercial 1	0.006	0.002
	0.004	0.0015
	0.002	0.001
	0.0015	0.0007
Precision 1	0.001	0.0004
	0.0005	0.0003
	0.00025	0.0002

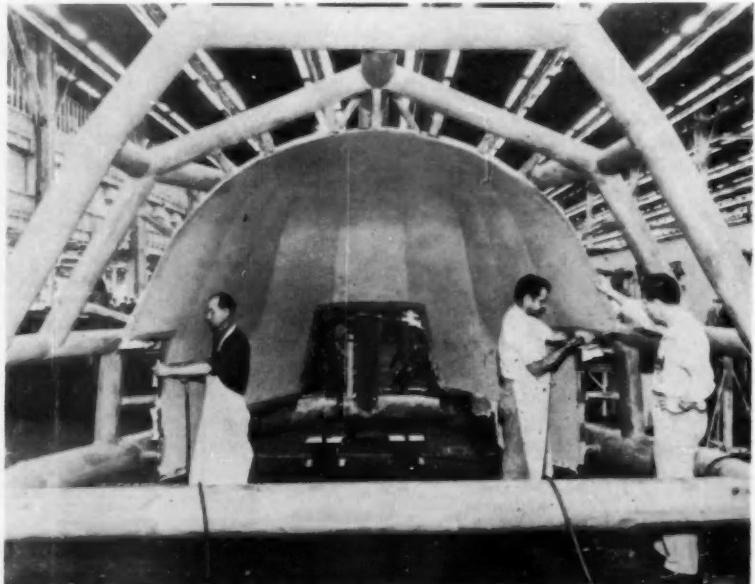
Tolerances on fine pitch gearing taken from AGMA standard 236.03

# Plastic Jigs and Fixtures Facilitate Short Aircraft Production Runs

THE Hercules C-130, first U. S. turboprop transport to reach production, is being built with plastic tools and as a result, significant savings are being recorded in time and cost. Plastic trim jigs, checking fixtures and other tools that Lockheed Aircraft Corp., Georgia Div., employs to produce this new and advanced-design transport are light and accurate glass-reinforced laminates made with liquid compounds based on Bakelite epoxy resins.

Relatively short aircraft production runs, cut even shorter by frequent design changes, make jigs, dies, tools, and fixtures costly items to amortize. About 10,000 of the nearly 50,000 parts estimated for making the new transport (not counting nuts, bolts, and rivets) are made with plastic tooling.

Extremely tough, dimensionally stable, and lightweight tools are being quickly con-



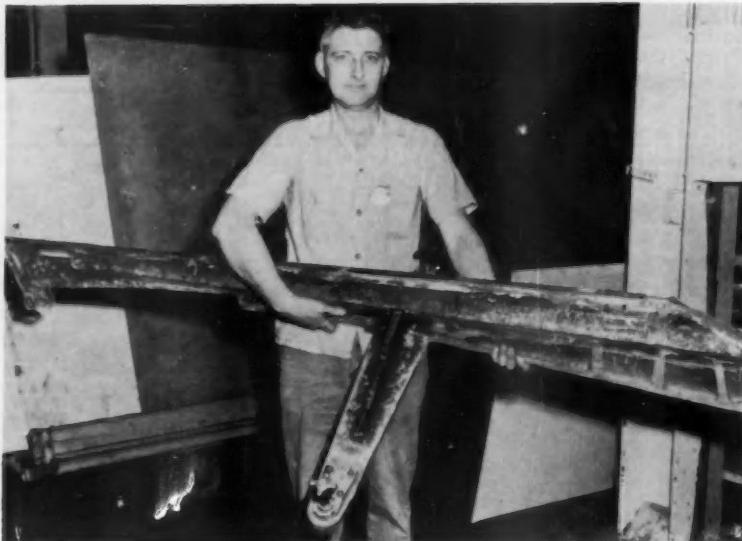
Huge master gage for checking Hercules upper front window area. This epoxy-glass and steel gage is 18 ft wide, 14 ft deep, and 9 ft high.

structed from L-900 and L-910 Toolplastik epoxy compounds supplied by Rezolin, Inc. Tools

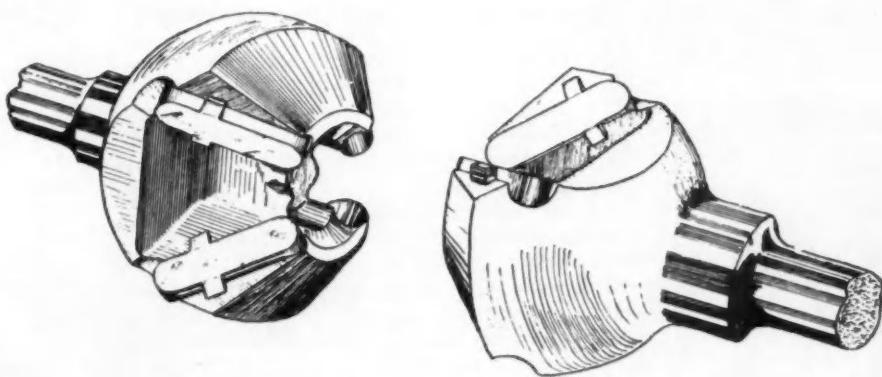
made with the epoxy resin and glass cloth are constructed without applying pressure and are said to have low shrinkage.

The largest plastic tool made at Lockheed is a master gage for checking the alignment of the Hercules' whole upper front window area. Epoxy-glass laminate is used for the shell while the frame of the huge gage is made of normalized steel. The gage is 18 ft wide, 14 ft deep, and 9 ft high.

Another tool, used for setting



Reinforced plastic tool for setting ailerons.



## British Universal Joint

A CONSTANT-VELOCITY universal joint has been developed by Garringtons, Ltd., of Bromsgrove, Worcester, England. This, it is claimed, can transmit uniform motion up to an angle of 35 deg, is self-supporting, and does not require a splined sleeve for angle compensation. When two units are used in tandem their alignment is immaterial.

The joint consists of two main forgings with no intermediary component. Each member carries four elliptical pads of semi-circular section which are keyed into machined recesses in the cutaway segments to permit axial movement. The two members are inter-

locked by contact through the flat faces of opposed rocking pads.

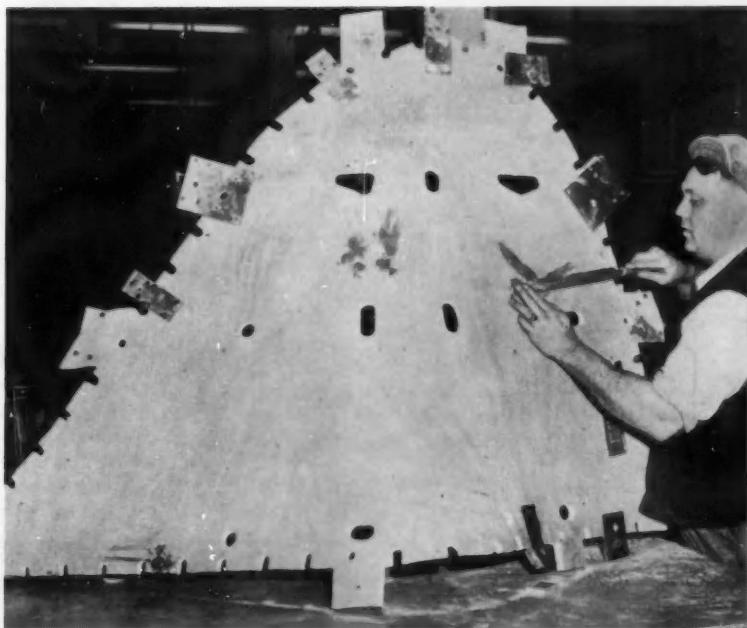
Contact areas on both driving and following pads are in identical positions at all displacement angles. Large wiping surfaces are designed to increase the load distribution, and all main loading is of the compressive type.

---

the ailerons, is constructed of a plywood frame reinforced with epoxy-glass laminates and given an epoxy coating for weather protection.

Plastic tools for joining wing or tail surfaces to the fuselage are made by bonding 10 or 12 layers of glass cloth with epoxy compounds to form a laminate  $\frac{3}{8}$  in. thick. After being cast, rough edges are removed and drill holes are spotted to specifications. One of these plastic tools is illustrated here.

Epoxy-glass laminate tools of the type shown are used for joining tail and wings to the fuselage.



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On all Air and Hydraulic Cylinders

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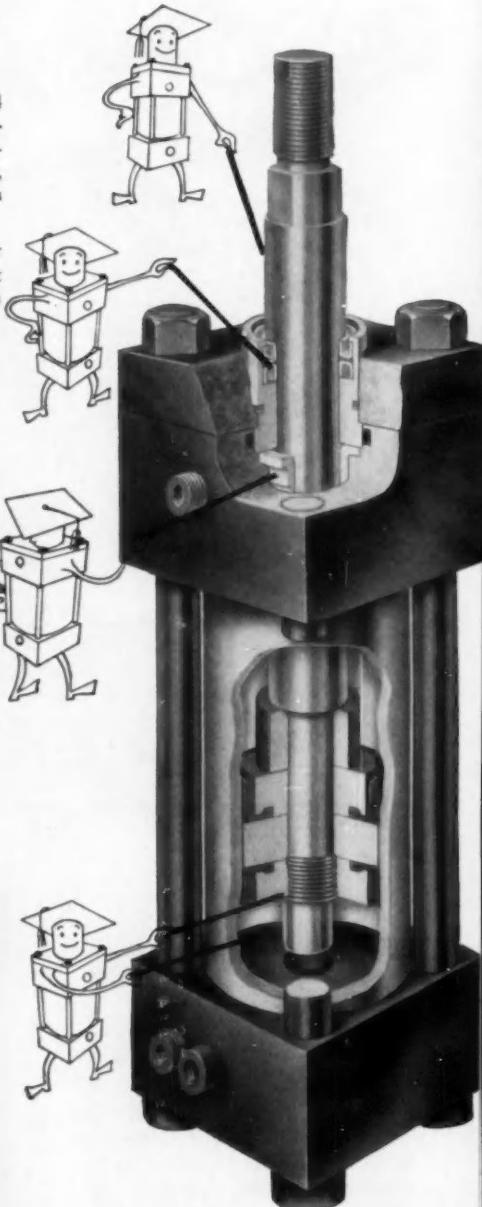
#### **Benefits To You**

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from -100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. Available from *Miller* at no extra cost.

#### **Benefits To You**

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish at no extra cost on all *Miller* cylinders. (This finish not recommended for water service.)



**NOTE.** On all *Miller* Hydraulic Piston Seals: Leather Cup Seals are standard, Piston Ring Seals are optional at no extra cost, and "Teflon" Cup Seals are available at extra cost.

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# Gearing Requirements

(Continued from page 69)

systems is completely dependent on the linear quality of the electronic and mechanical components.

In the near future electronic components will be available with greatly reduced linear errors. Gearing will have to match this improvement in electronic components.

At present, these systems are designed around the limitations of available components. The need for improved systems is always present, particularly, in the areas of national defense and impending space travel.

As aircraft and missile speeds increase, data concerning range and position coordinates must be more accurate. The function of some radar and computing systems is to provide these data. Some systems are airborne while some are ground based. The ground based systems are larger, more complex and possess ranges of 200 miles or better. At such a range, it is evident that a small error in pointing at the radar station represents a much larger error at the position of the object being located.

At Convair we use the following as a guide in the design of precision equipment:

1. Gears are precision Class 1, 2 or 3 depending on the application.
2. Precision ball bearings of the highest grade are used, with special consideration given to their mounting.
3. Gears and housings are made of the same materials to reduce the effects of temperature changes.
4. Housings and shafts machined to extremely close tolerances both for size and concentricity.
5. Output gear of a critical mesh made as large as practical to reduce the angular effects of gear errors.
6. Gears are mounted on adjustable centers to reduce backlash when practical.

By no means does adherence to these design precepts eliminate all problems associated with precision gearing.

## ACCURACY

Accuracy can probably be best expressed as uniform angular displacement or velocity between meshed gears. There are many factors that can cause non-uniform motion between gears. Some factors will create only positional errors, while other factors will produce errors, plus a change in backlash.

When accuracy of angular motion is desired, it is not enough to eliminate only backlash. Spring-loaded split gears or a floating gear spring loaded against its mating gear will remove backlash but will not compensate for positional errors due to eccentricities and tooth-spacing errors. High quality precision gears must be used to obtain rotational accuracy.

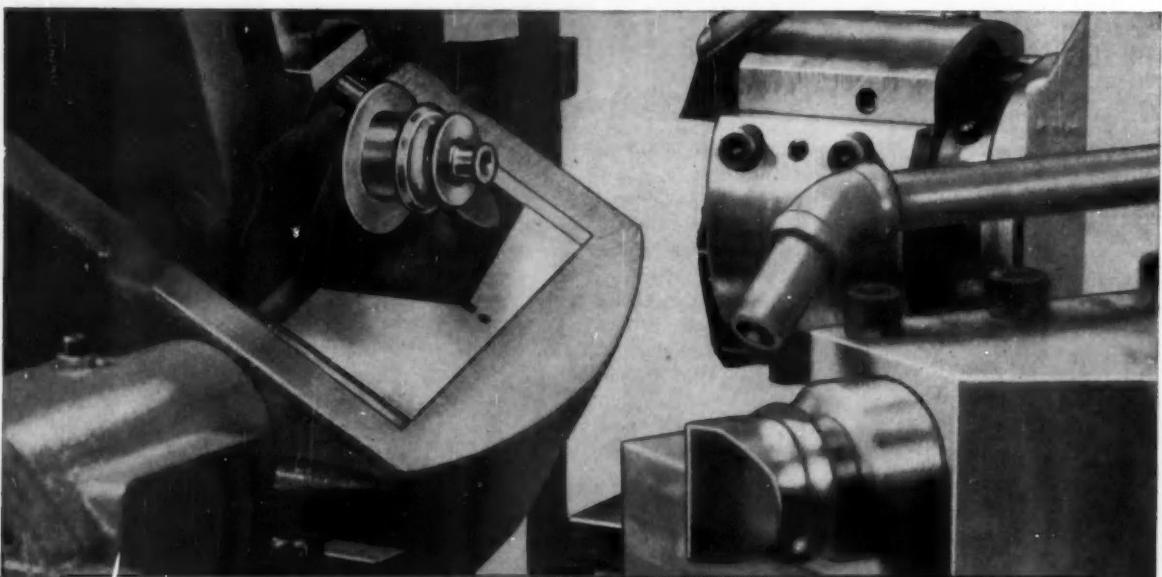
At this time it also might be well to point out that a problem exists in using gears defined by AGMA  
(Turn to page 136, please)

**STOP PIPE THREAD LEAKS with**

**TRU-O-SEAL**

**DIVISION**  
Flick-Reedy Corporation  
Metrose Park, Ill.

"Miller Fluid Power" is also a division of Flick-Reedy Corp.



**From PROBLEM to PROFIT**  
*in just 3.59 minutes... with a*  
**POTTER & JOHNSTON 6DRE-40**  
**Automatic Chucking Turret Lathe**

**HERE ARE THE FACTS**

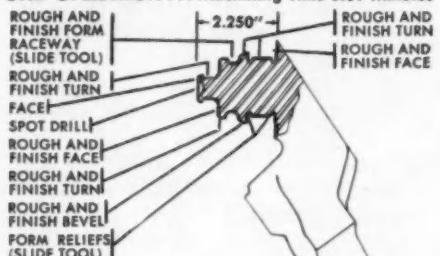
PART: Cutter Bit Arm

MATERIAL: 4612 Steel Forging

REQUIRED: 18 separate, precision cuts . . .  
including some "fussy" single  
point form turning.

COMPLETED: Quickly, economically in  
1 completely automatic cycle!

**ONE OPERATION . . . Machining Time 3.59 Minutes**



**HEAVY LINES INDICATE MACHINED SURFACES**

And remember, this is *not* an exceptional, "done-for-the-record" case history. It's a regular production job that typifies the day-in-day-out performance you can count on because a P&J 6DRE-40 has the advanced design, added rigidity, extra speed and power, and versatility to take tough jobs in stride. And when you team this P&J Automatic with tooling engineered by P&J Specialists, you

really have a cost cutting, profit building combination.

**SEND NOW FOR COMPLETE  
INFORMATION**

Write today for your free copy of  
Bulletin No. 159 describing the P&J  
6DRE-40 in detail. Complete engi-  
neering data is included.

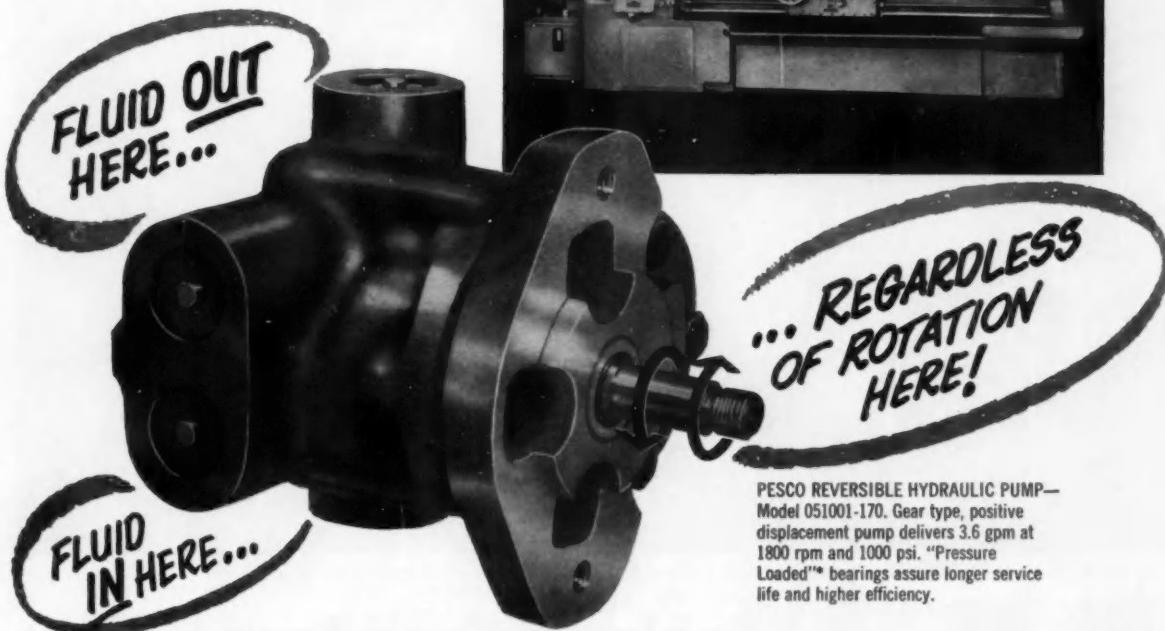
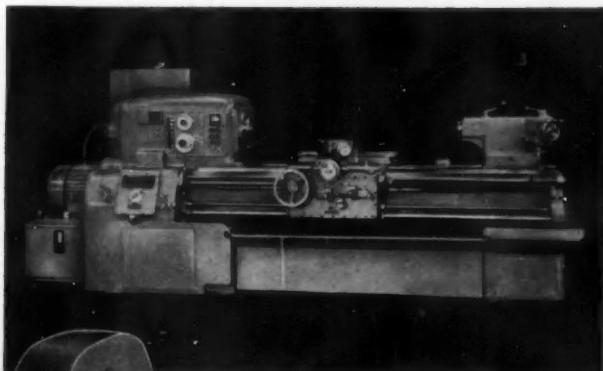


*Precision Production Tooling for more than Fifty Years*

**POTTER & JOHNSTON COMPANY**  
PAWTUCKET, RHODE ISLAND  
SUBSIDIARY OF PRATT & WHITNEY COMPANY, INCORPORATED

**MODERNIZE WITH POTTER & JOHNSTON . . . REPLACE FOR PROFIT**

USED ON MONARCH LATHES—The Monarch Machine Tool Co. uses a PESCO Reversible Pump to provide hydraulic power on its Series 62 and 80 lathes for headstock shifting and four-way power rapid traverse, and on the Series 90 lathes for head-stock shifting. Pump is belt driven by main drive motor (left).



PESCO REVERSIBLE HYDRAULIC PUMP—  
Model 051001-170. Gear type, positive  
displacement pump delivers 3.6 gpm at  
1800 rpm and 1000 psi. "Pressure  
Loaded"\*\* bearings assure longer service  
life and higher efficiency.

unique Pesco Hydraulic Pump  
has  
**one-way**  
**flow...**  
**regardless**  
**of**  
**rotation!**

No matter which way you rotate this new PESCO Hydraulic Pump, flow is always in the same direction—inlet and outlet ports do not change! Startling? Yes . . . but it is typical of the valuable contributions now resulting from PESCO's creative engineering.

This PESCO pump is the answer for applications having a dual rotation power source, but requiring single direction hydraulic flow. On machine tools, for example, it can be run off the main drive motor to provide constant hydraulic power regardless of rotation. And for power take-offs on trucks and tractors, this pump gives correct flow independent of rotation.

Where can you use this pump? Samples are in stock and available to original equipment manufacturers for testing. Production requirements can be met promptly. For detailed information or specifications, contact your nearest PESCO sales engineer, or write: PESCO, 24700 North Miles Road, Bedford, Ohio.

\*PESCO's patented principle  
of gear pump construction



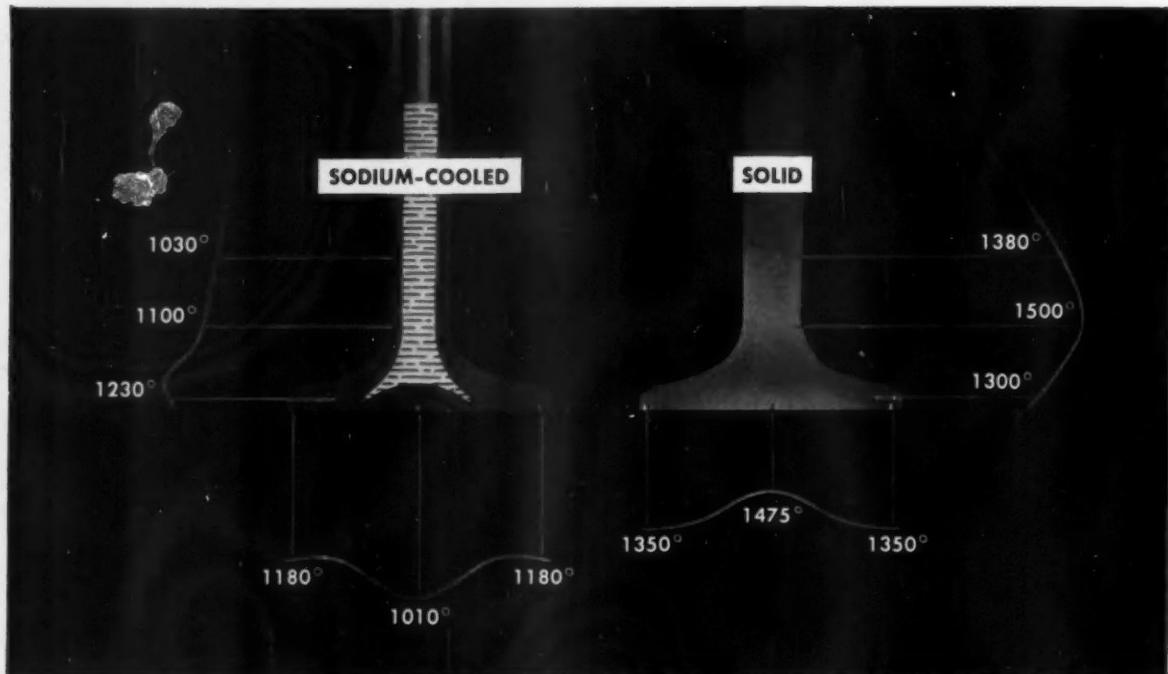
**PESCO PRODUCTS DIVISION**  
**BORG-WARNER CORPORATION**

24700 NORTH MILES ROAD • BEDFORD, OHIO

Producing the Best in Hydraulic Pumps, Fuel Pumps, Electric Motors and Axial Flow Blowers



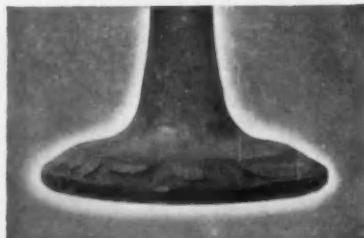
# Eaton Sodium-Cooled Valves Run Cooler—



These curves show operating temperatures of Sodium-Cooled and Solid Valves under similar conditions of high output.



Eaton Sodium-Cooled Valve after 110,000 miles—still in good condition.



Conventional valve after 35,000 miles in same type of operation as Sodium-Cooled Valve shown above.

## Cooler Valves Last Longer

Today's trend in engine design toward higher speeds and more economical fuel-air ratios results in higher temperatures for many operating parts—including exhaust valves. These higher temperatures sharply reduce valve resistance to corrosion and distortion, definitely limiting valve life. Eaton Sodium-Cooled Valves, operating at considerably lower temperatures, maintain corrosion resistance and strength.

In general, maintenance of Eaton Sodium-Cooled Valves in heavy-duty truck engines is scheduled only at time of major engine overhaul. No in-between trips to the shop are necessary for valve servicing. Engine output is maintained at high levels over long mileages. In many millions of miles of heavy-duty operation, Eaton Sodium-Cooled Valves have proven their ability to keep trucks on the road and out of the shop.

Eaton engineers will be glad to work with you in applying the benefits of Sodium-Cooled Valves to your engines.

# EATON



**PRODUCTS:** Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings • Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

VALVE DIVISION  
MANUFACTURING COMPANY  
9771 FRENCH ROAD • DETROIT 13, MICHIGAN

# Self-Locking Self-Sealing

# LOK-THRED®

U. S. Patent No. 2437638

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LOK-THRED seals as it locks . . . re-forms the receiving thread into an intimate metal-to-metal contact with itself to eliminate every void between the mating threads.

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Chester Hoists





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HUNTER DOUGLAS  
Pre-painted  
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**WIDE RANGE OF COLORS**—Get the color you need to harmonize or contrast with other décor.

**STOCK SPECIFICATIONS**—If your production can use mill quantities (20 M lb./minimum) in widths up to 8" x nominal thicknesses, ask for quotations.

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# News of the MACHINERY INDUSTRIES

By Thomas Mac New

Bullard's New Foundry, Designed for Large Machine Tool Components, Will Permit Expansion in Production. Orders for New Machinery Continue to Increase.

## Bullard Opens New Foundry

The new \$7 million, 220,000 sq ft, Bullard Co. foundry in Bridgeport, Conn., was officially opened for business last month. Actually, according to Bullard's president, E. C. Bullard, the new plant poured its first metal during the week of April 30 and now is beginning to hit its production stride.

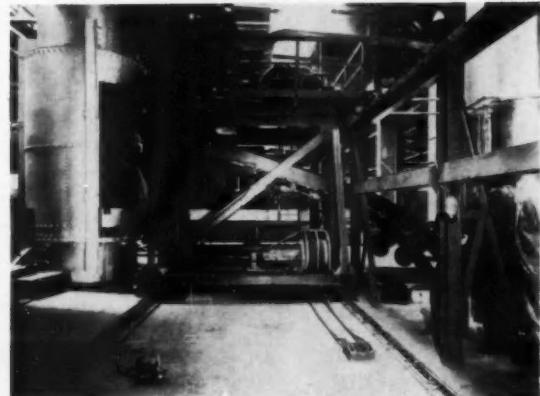
The foundry, one of the most modern of the heavy jobbing type, has been equipped to handle gray iron castings up to 50 tons. However, the building has been constructed to take 75 ton cranes when production warrants 50 per cent heavier castings.

Bullard's management states that the new facility was planned after the advent of the exceptionally large Model 75 line of Bullard machine tools. The company's old foundry could not produce the large individual castings required nor could it fulfill the anticipated increase in business.

Built on the continuous-flow production principle, the foundry uses automatic charging equipment, automatic shake-out and sand recovery, mobile sand slingers, and 17 cranes ranging from three to 50 tons capacity. One of the most interesting units is the automatic charging bucket which moves up an inclined track from the loading area to the charging deck. The bucket then enters a transfer car which is designed to move along the charging deck to a pre-selected cupola. At the cupola, the charging bucket is extended into the cupola on cantilever arms where the charge is dropped. Currently, Bullard has equipped the foundry with two No. 8 cupolas lined to 60 in. The daily estimated capacity is 100 to 125 tons. The plant has been designed to accommodate another cupola if and when required.

Layout of the new \$7 million Bullard foundry is shown at right.

This electrically operated transfer car carries the charging bucket to either of two cupolas in the new Bullard foundry. An innovation in foundry practice, the operator on the loading floor pre-selects the cupola, and the charging bucket moves up the ramp from the loading area to the charging floor, then the transfer car takes over to carry the bucket and dump its contents into the preselected cupola.



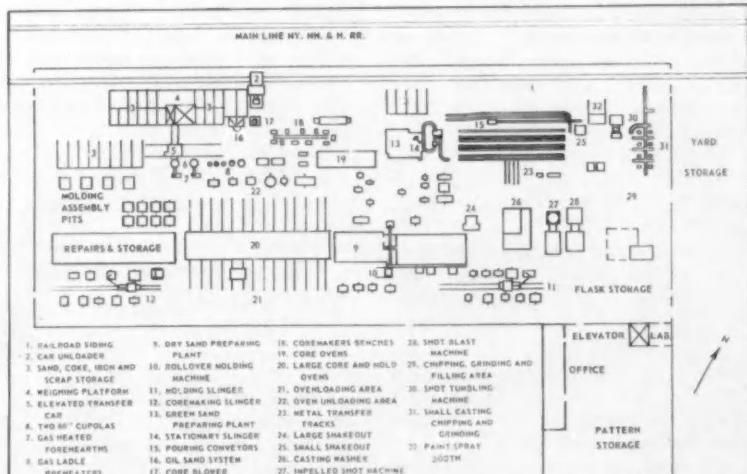
## Orders for Machine Tools Continue at High Level

All signs point toward a continuing upward trend in the machine tool industry. Sparked by industry's current drive to cut manufacturing costs, new orders for machine tools for the first five months of this year climbed by about 53 per cent above the same period last year to a total of \$474.6 million. New orders in May

alone increased 30 per cent above the same month last year and 10 per cent ahead of April, further reflecting the current upswing.

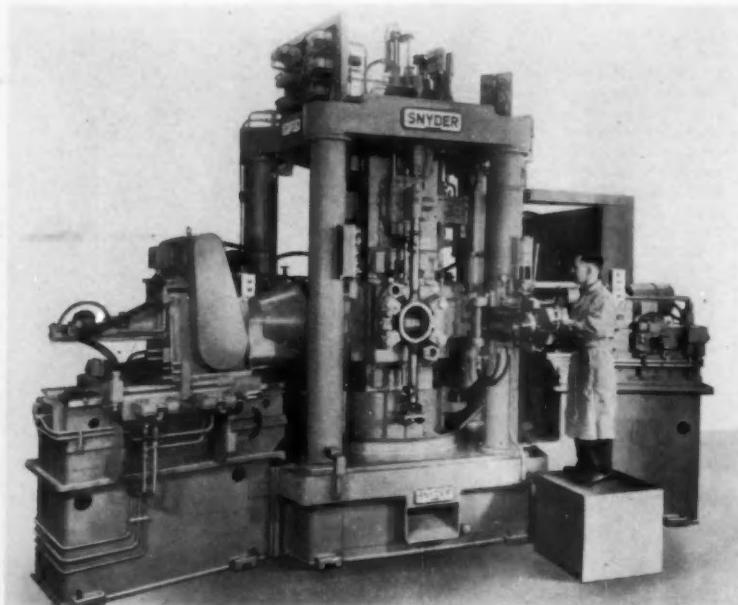
While some companies note soft spots in sales, particularly firms building machines for automobile producers, most feel 1956 will turn out to be a good year. Most automobile companies have completed ordering tools for 1957 models, and tool com-

(Turn to page 160, please)



# NEW PRODUCTION and PLANT EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89



Snyder vertical trunnion index machine for long parts

## Vertical Trunnion Index Machine

FLOOR space requirements are said to be reduced with a five-station vertical trunnion index machine designed for machining long parts such as automotive axle housings. The new machine is stated to have the space-saving advantages of a center-column type machine tool, but has no index table as such. Instead, the center column itself holds the work fixtures and rotates the parts from station-to-station.

The hydraulically-operated, electrically-controlled machine rough and finish faces the housing banjo flange, drills and reams ten holes in the flange mounting face, and chamfers both sides of the holes. It produces 105 housings per hour at 100 per cent efficiency. Three single-point carbide tools are used to rough and finish the flange. A large hydraulic cylinder advances the tools across the face during machining through a drawbar and bellcrank mechanism.

To chuck the housing, it is loaded in the fixture over a lower arbor that

enters a semi-finished bore. Then the upper arbor enters the semi-finished bore in the other end of the housing. Next a centralizing locator on a swinging gate is moved into position in the housing. Then a jaw chuck clamps the housing flange section based on the location indicated by fingers on the locator which bear on the inside surface of the flange outside diameter. When the locator gate is swung out of the work, the machine indexes to the first machining station. *Snyder Tool & Engineering Co.*

Circle 30 on postcard for more data

## Eddy Current Brake

THE development of eddy current braking for electric monorail type hoists that is said to provide positive, accurate control from no load to full capacity when hoisting or lowering, has been announced. The brake reportedly senses the percentage of full capacity load being handled and multiplies the brake load resistance

so that the motor is loaded to approximately 100 per cent at all times. It consists of a stationary field ring centered around a rotor mounted on anti-friction bearings. The rotor turns in a field of magnetic flux with no mechanical or electrical connections. Poles on the field ring, which receive direct current, are stationary so that there are no moving electrical parts in contact. The braking force is accomplished through the breaking of magnetic lines of force between the stationary pole ring and the revolving rotor. *Yale & Towne Manufacturing Co.*

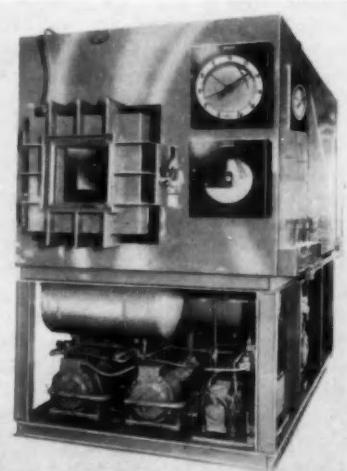
Circle 31 on postcard for more data

## Altitude Test Chamber

THE altitude test chamber illustrated is designed and built to simulate altitudes up to 150,000 ft. It features automatic control of temperatures from -100 to +250 F. Humidity can be controlled as desired from 20 to 95 per cent.

Similar type test units are available in sizes from very small test compartments to large walk-in rooms; and can be designed to meet particular or variable conditions. *Webber Manufacturing Co.*

Circle 32 on postcard for more data



Webber altitude test chamber

## Industrial Oil Coolers

FEATURING a high rate of heat transfer per unit of space occupied, a new line of air type and water type oil coolers is now available for industrial hydraulic systems.

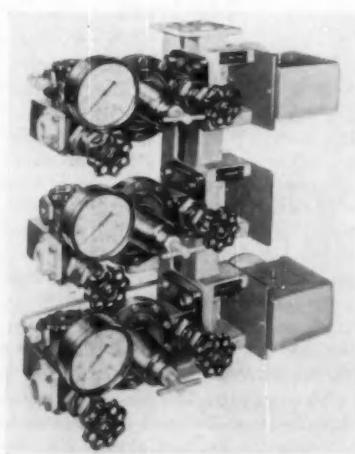
Designated Series OCW, the water type coolers are obtainable in single unit sizes for oil flows up to 100 gpm and for continuous power removals up to 37 hp, based on 85 F entering water temperature. Greater requirements can be met with two smaller coolers of equal size used in parallel. Maximum recommended working pressure is 75 psi for both the oil and water sides.

Designated Series OCA, the air type coolers are suggested for application where cooling water is at a premium or where waste heat can be used to warm space. High rate of heat transfer is said to result from a patented turbulator that breaks up the flow for maximum dispersion of oil against the walls of the heat transfer tubes. These coolers are available in single unit sizes for oil flows up to 70 gpm and for continuous power removals up to 13.2 hp, based on 100 F average ambient temperature. Maximum recommended oil pressure is 150 psi. Vickers Inc.

Circle 33 on postcard for more data

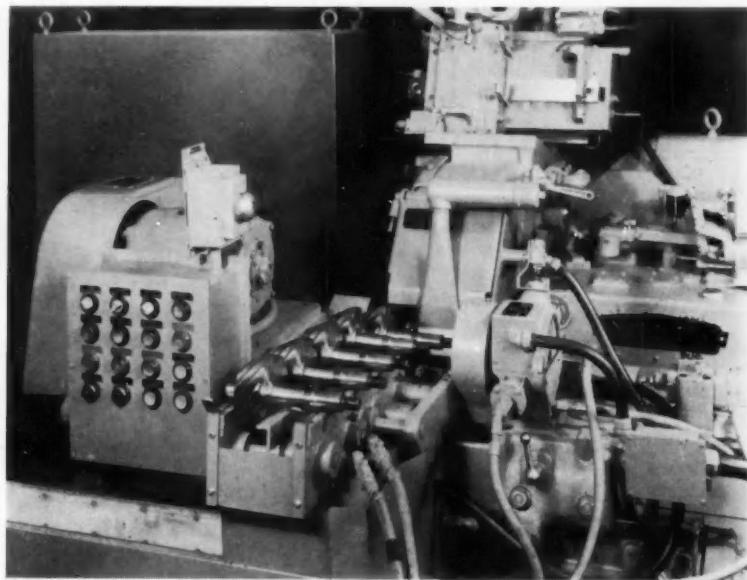
## Press Air Manifold

ILLUSTRATED is an air manifold for presses which is said to provide a simple and efficient means of regulat-



Clearing press air manifold

ing the air supply to the clutch and brake unit, counterbalance cylinders and die cushions. All of the valves,



Norton automatic stem pinion grinder

## Automatic Grinder for Stem Pinions

FEATURES of an automatic machine for grinding stem pinions include special workholding and driving equipment with automatic loading and unloading devices. Automatic controls are incorporated into the machine to permit one operator to supervise the production of more than one machine. In this new grinder, the pinions are placed in a loading chute which automatically moves the pinion down inclined ways toward a revolving turret which then places it in position for the footstock center to engage the center hole and push it forward into the floating type collet in the headstock. The grinding cycle time is pre-selected on the basis of stock removal and finish requirement.

Upon completion of the grind, the revolving turret takes the pinion from the centers and discharges it into an unloading chute from which it rolls onto the conveyor on the front of the machine.

Grinding wheel truing is automatic at predetermined intervals by a wheel-head mounted device. In addition, this device gives close control of the amount of abrasive removed from the wheel face. The wheel head is automatically reset to compensate for the reduced wheel diameter after truing.

Interlock controls are provided so that automatic actions occur in the proper order. Improper action shuts down the machine. Norton Co.

Circle 34 on postcard for more data

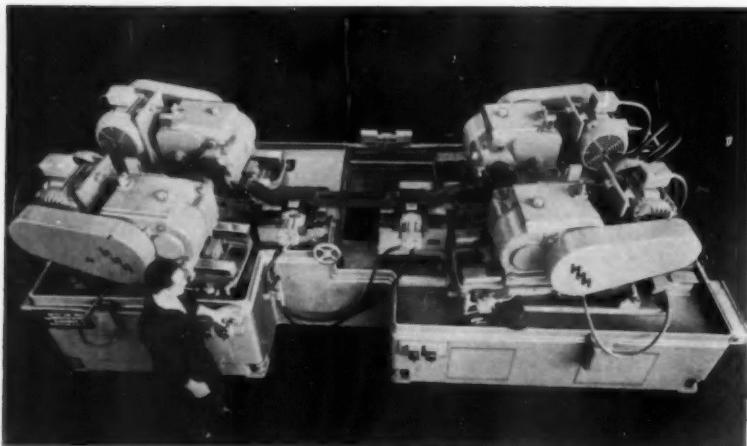
regulators, gages and switches necessary to operate these units have been combined into a compact package.

The devices required for regulating the supply of air have been grouped into a single composite air valve. The elements of the composite valve include a shut-off valve, pressure regulator, pressure gage with needle throttle valve, check valve and exhaust valve. These components are mounted on a cast housing, measuring only 10-in. from end to end. Consequently, there is no intermediate piping to be done between each of the parts.

A unique header brings together

into one package as many air valves and pressure switches as are required for complete press control. These headers provide flanges for mounting both the air valves and air pressure switches. The headers are designed so that when the air manifold is bolted to the header, connections are made to both the air inlet and the exhaust simultaneously. The units are furnished in either two or three station sizes. They are provided with flanges so that larger assemblies of four or more stations can be bolted together. Clearing Machine Corp.

Circle 35 on postcard for more data

**NEW****PRODUCTION  
and PLANT EQUIPMENT**

Motech &amp; Merryweather double duplex miller for truck axles

**Double Duplex Machine Mills Kingpin Bosses**

THE milling machine illustrated incorporates two pairs of opposed heads that simultaneously mill the kingpin bosses of forged steel axles. Two surfaces on each end of the front axle are face-milled in relation

to the mounting surfaces.

The machine has two tables, one on each side of the base, which are adjustable so that various angles can be set to mill the surfaces of the part. On each table are mounted op-

posed (right and left hand) milling heads, each on ways. The right-hand table is mounted on ways in order to adjust the distance between the pairs of milling heads. Each quill has a two-in. adjustment so that distance between the milling cutters can be set. The fixturing is universal in type to equalize endwise and provide for variance in part design and size.

The part is loaded by hoist into the fixture and the operator mechanically equalizes it endwise. Hydraulic clamping is done when the cycle button is pressed. The cycle consists of rapid traverse of the four milling heads to milling position, feed of four heads simultaneously across the surfaces to be milled, stop, rapid traverse return to the starting position, and fixture unclamping.

All machine movements are automatic, except for loading and unloading the part. The control and actuation are by hydraulic power. Milling heads are single speed, with provision for speed changes by change gears. *Motech & Merryweather Machinery Co.*

*Circle 36 on postcard for more data*

**Electrostatic Paint Spray System**

FEATURING a patented gun with a unique nozzle, the "Ionic" electrostatic spray system is said to present advances in paint application. The new system, powered by a 140 kvp high potential power supply, utilizes a conveyor which forms almost a complete closed loop around the gun

which is mounted in the center of the loop reciprocating vertically. A cone or disc-shaped ionizing electrode is attached to the nozzle on the gun. The spray pattern, which can be adjusted to furnish either a 360-deg or umbrella-shaped pattern by moving the outer sleeve of the nozzle either

forward or backward, is set so that the spray will hit the cone or disc-shaped electrode and be deflected off in the form of a mist. This ionized mist is attracted to the work being processed, which is at ground potential on the conveyor. *Ionic Spray Div., Scientific Electric.*

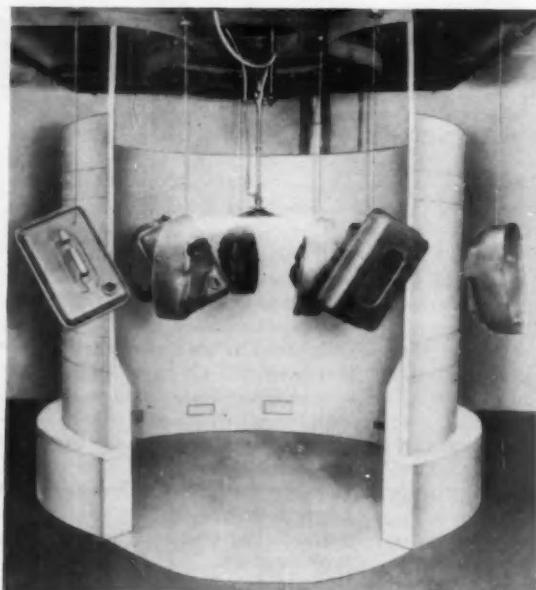
*Circle 37 on postcard for more data*

**Die Steel**

A CHROMIUM - MOLYBDENUM - VANADIUM die steel called Moldtem is being marketed in blocks and bars for plastic molds and zinc die casting dies. These blocks and bars are available in a range of standard cross-sections; orders for special sizes also can be filled. Although the material is prehardened to a range of 302 to 341 Bhn and generally requires no further heat treatment, the company indicates it will take, when desired, such superficial surface hardening as nitriding, carburizing and chrome plating.

The company is currently marketing the new die steel as specifically suitable for making closed dies for plastic injection or compression molds; but the announcement states it has also been found satisfactory for forming dies for zinc castings. *Hepenstall Co.*

*Circle 38 on postcard for more data*



Scientific electrostatic spraying equipment provides an umbrella-shaped ionized mist pattern which is attracted to parts being painted

## Germanium Rectifiers

GERMANIUM electroplating rectifiers, fully protected against circuit overloads, have been developed utilizing the new General Electric germanium "safety cell," hermetically-sealed to protect the germanium wafer from the deteriorating effects of moisture and corrosive fumes. Basic stacks consist of six germanium cells, each with cooling fins. The stacks are of a standard design, are interchangeable, and are rated at approximately 500 amp each.

Each germanium cell is individually protected against circuit fault conditions and sudden overloads by fast-acting "amp trap" fuses which break the circuit before irreparable damage can be done to the heat sensitive germanium junction. All units are forced air cooled, being equipped with centrifugal blower. The three-phase blower motor is provided with a separate magnetic starter to guard against overloads. The unit is further protected from the build-up of destructive temperatures due to blower failure, by a "pressure switch." In addition to individually-fused germanium cells, the rectifier is protected against single phasing on the three-circuit. The main magnetic starter is provided with a thermal breaker for overloads.

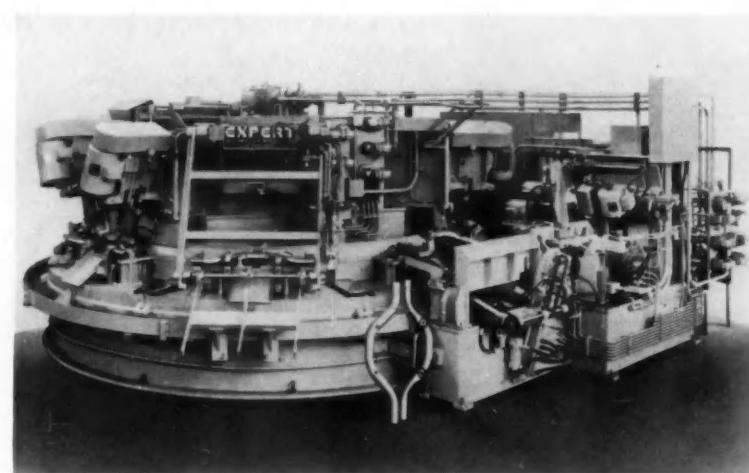
Efficiencies as high as 95 per cent are possible, depending upon current and voltage, and these units will operate indefinitely at up to 150 per cent of rated current, it is said. A voltage range from 6 to 48, with current output up to 50,000 amp, will accommodate most metal finishing needs.

The new rectifiers can be provided with any popular type of automatic or manual control, situated either integrally on the rectifier cabinet, or as a remote control. The units are available in two basic cabinet sizes: 28 by 28 by 64 in. for up to 3000 amp, and 28 by 54 by 64 in. for units with capacities from 4000 to 6000 amp. *Wagner Brothers, Inc.*

Circle 39 on postcard for more data

## Oil, Water Extractors

TWO oil and water extractors featuring an air capacity of 100 cfm, have been announced. The Model AO-125 reportedly supplies up to 100 cfm of clean, dry, regulated air to as many as six heavy duty spray guns at the same time. An enlarged and improved air regulator on the extractor is credited for the increased air capacity. The Model AO-124 is



*Expert 12-station automatic drilling machine combines in-line transfer and rotary index machine concepts to drill, spotface, ream and deburr holes in frame cross members*

## Automated 12-Station Drilling Machine

COMBINING the features of an in-line transfer machine with those of a large center column rotary index machine, an automated 12-station drilling machine, electrically controlled and hydraulically operated, drills, spotfaces, reams and deburrs holes in a 39-in. long, 2½-in. OD bent tubular steel automotive frame cross member at the rate of 200 pieces per hour. The rotary index machine has a 12-ft. diam cast aluminum sectionalized table. The 6000-lb weight saving brought about by the use of aluminum, plus a new mechanical cam index mechanism, enables a two-hp motor to

rotate index center column machine.

Unusual automation devices are said to be included in the machine to transfer the parts from the in-line machine to the index machine, as well as to unload the parts from the index machine. Parts clamping pressure variations in the fixtures on the rotary index machine due to stamping deviations are reportedly avoided by the use of a new type of leaf spring and over-center toggle clamping mechanism arrangement. *Expert Automation Machine Co.*

Circle 40 on postcard for more data

the same as the AO-125 but lacks the air regulator. Designed for use on



*Binks Model AO-125 oil and water extractor*

main lines requiring non-regulated air, its high air capacity results from larger air inlet and outlet sizes.

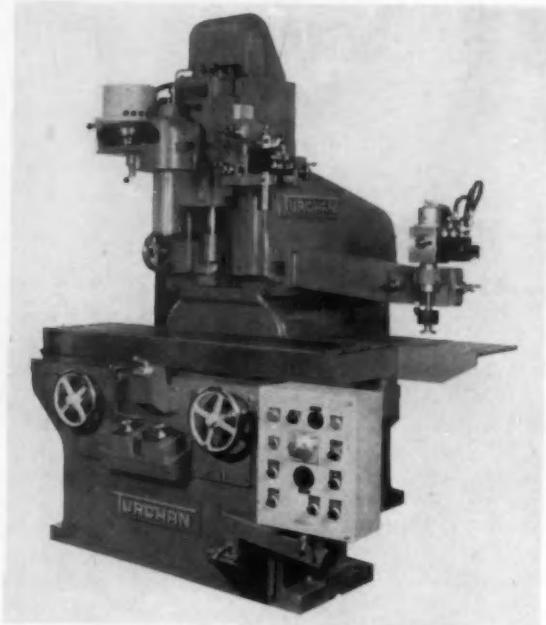
A combination of spiral baffles and absorbent filter removes impurities from the air before they reach the spray gun. The cutaway area of the illustration shows these baffles and filter in air-cleaning action. As the air rotates around the baffles, centrifugal force carries the impurities out of the air stream where they drop to the bottom of the extractor for draining. After leaving the baffles the air enters the washable filter for final screening before going to the spray gun.

Both models feature an automatic drain which opens when the air supply is shut off and closes when the air supply is turned on. They are also equipped with manually operated drains. *Binks Manufacturing Co.*

Circle 41 on postcard for more data

**NEW**  
PRODUCTION  
and  
**PLANT EQUIPMENT**

**Bed-Type Die Sinker Operates in Three Ways**



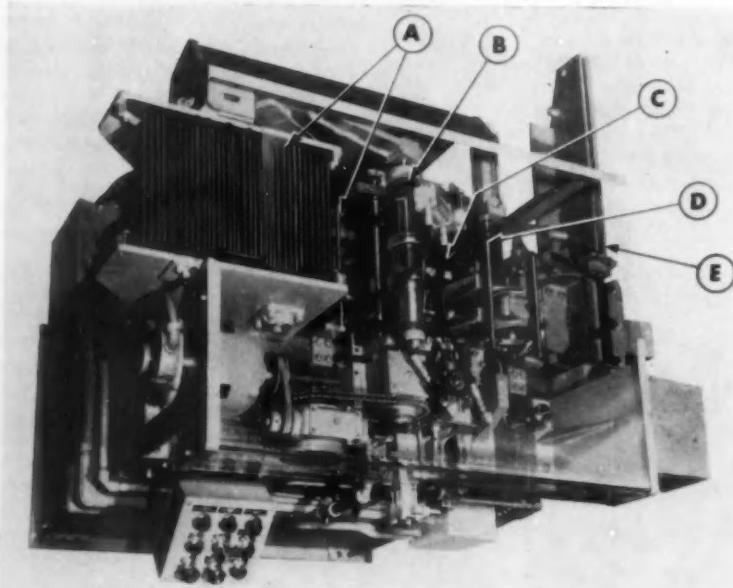
*Turchan automatic bed-type die sinker is equipped with a magnetic tracer, is designed for three-way operation, and has a table 17 by 57-in.*

A FULLY automatic bed-type die sinker equipped with a magnetic tracer can also be used as a power-operated straight milling machine or as a hand-operated straight milling machine. The desired method of operation is selected by positioning the central knob of the control panel. When the machine is on fully automatic, the operator can set the length of stroke to cover the workpiece and select the index or pick-feed desired at the end of the cut.

As the tracer automatically coordinates the vertical movement of the cutter with the table and ram movements to reproduce accurately the profile of the master model, electric limit switches control adjustment of length of stroke on table and ram. The table is 17 by 57 in. Workpiece and model are mounted on a common base. *Turchan Follower Machine Co.*

Circle 42 on postcard for more data

**Automatic Shaft Straightening Machine**



*The automatic shaft straightening machine illustrated handles 600 pieces an hour in preparation for centerless grinding. Synchronization with the grinders is not necessary because a 30 part storage chute automatically starts and stops the straightener as parts are demanded by the grinder line. Straightness is held to 0.0015 in. tir at the center. Out-of-straightness up to 0.125 in. tir at center can be accommodated. The shafts are fed from a loading and storage hopper (A) to a walking beam conveyor which carries them to the straightening station (B). Here, rolls apply a programmed load at the shaft center while the shaft is rotated. A gaging station (C) checks the straightened shafts. Reject mechanism (D) removes those outside tolerance. The conveyor advances those within tolerance to the feeder (E) which serves the following operation. (Cargill Detroit Corp.)*

Circle 45 on postcard for more data

**Honeycomb Machining**

STAINLESS steel honeycomb structures can now be machined without loss of accurate dimensions, according to an announcement, by the use of a newly developed hot-melt compound. The compound, called Hot Melt H-883-A, which has a low linear shrinkage, maintains the cells of the structure during the machining operation. In practice, it is melted at a temperature near 200 F in stainless or aluminum pans, and the honeycomb is inserted in the hot liquid. After cooling and after machining, the compound may be melted from the honeycomb, with final cleaning in hot water. *Furane Plastics, Inc.*

Circle 43 on postcard for more data

**Fume Hoods and Ducts**

MADE of polyester glass plastic, a line of fume hoods, ducts and stacks is said to offer light weight, high impact strength and high corrosion resistance to hydrochloric acid and other fumes normally corrosive to other materials. It is claimed that both initial material cost and installation, and maintenance cost, are substantially lower than for materials that will offer comparable corrosion resistance. Ease of fabrication, both for initial construction and possible changes, is also featured. *Haveg Industries, Inc.*

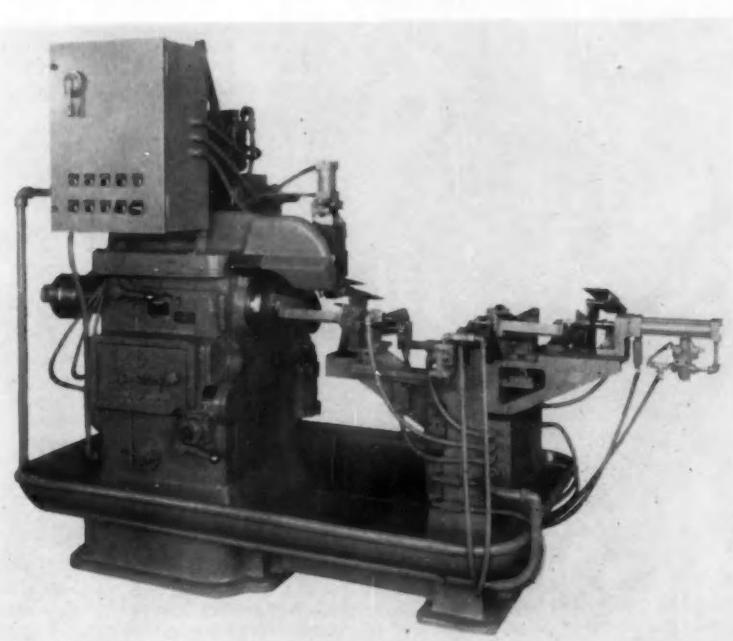
Circle 44 on postcard for more data

## Standard Lathe Equipped and Automated for Specialized Work

To meet the requirements of removing a welding flash on a worm shaft assembly at a high production rate, a new automatic lathe was equipped with standardized units comprising a pedestal base, a combined headstock and feed works unit, a headstock turner slide, and a packaged automatic loader and ejector mechanism.

In operation, the welded parts are delivered to the lathe, red hot from the welding machine, by a conveyor which joins the loading chute, and flow by gravity to the fixed stop, which is the loading position. Upon the completion of a finish turned part, the spindle stops, the hinged steady rest roll carrier is retracted, the collet chuck opens and the finished piece is ejected from the collet by a spring loaded ejector rod. The part is deposited on the unloader arms, which swings the finished piece into the discharge chute and then returns to the receiving position.

At this point, an elevator assembly raises a rough piece over the loading chute stop into the loading cradle, which remains in the raised position until the part is injected into the collet chuck by the pneumatically-operated plunger. The collet chuck closes, the elevator assembly retracts, the hinged steady rest roll carrier automatically closes, the headstock spindle clutch is engaged, the tools on the overhead slide advance to the cutting position, and the flash is re-



Seneca Falls Model LN automatic lathe has equipment for specialized high production

moved and burnished, after which the tools retract and a new cycle begins.

While the entire loading, machining and unloading operations are automatic, pushbutton controls are installed for the manual operation of each movement. The loading cycle cannot get out of time since the

automatic sequence is controlled by a system in which each movement is initiated by the completion of the preceding movement. It is said a production rate of 275 pieces per hour is obtained with this equipment.

Seneca Falls Machine Co.

Circle 46 on postcard for more data

## Roller-Leveller

INTRODUCED is a roller-leveler for straightening sheet stock, coil stock (for automatic feeds, in conjunction with punch press operations), producing cut length flat sheet from coil, and livening (work annealing) deep drawing steel.

The machine operates at a standard speed of 56 fpm. A single sprocket change can increase or decrease this speed as required. Power source for the unit is a gearhead, single-speed motor (or an optional variable speed drive).

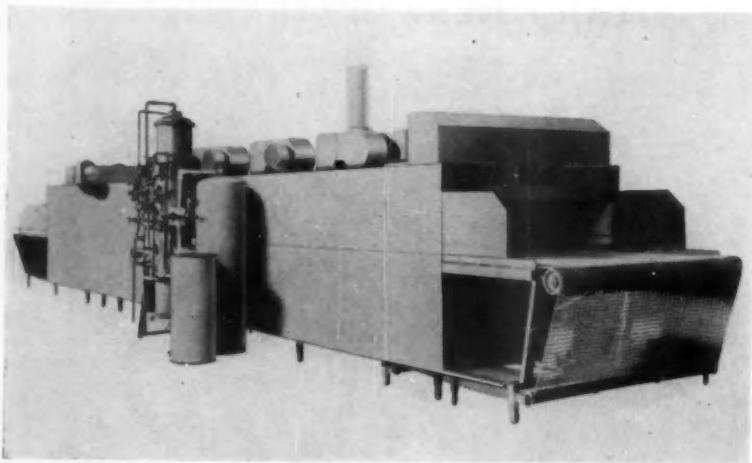
All eleven straightening rolls and the two feed rolls are made of alloy steel hardened, ground and hard-chromium plated. The rolls run in roller bearings, and all except the top feed roll are power-driven through an enclosed gear box. F. A. Woehr Machine Co.

Circle 47 on postcard for more data

The Woehr roller-leve-  
ller, Model 11-F, flat-  
tens mild steel, hard-  
tempered steel, stain-  
less steel, aluminum,  
brass or copper in  
widths up to 42-in. and  
in gages from 0.020 to  
0.093-in.



**NEW**  
PRODUCTION  
and  
PLANT EQUIPMENT



*Stoelting automatic washing machine*

#### Automatic De-Ionized Water Washer

A N automatic water washer for spotless cleaning of metal parts or products has been developed. The purity of surface is said to be obtained by cleaning stages which include rinsing with de-ionized water.

In prior washes an alkaline base detergent or acid is used to remove any accumulation of grease, dirt, grit or dust; and this is followed by tap water rinses and drying cycles. The washer is so designed that all wash solu-

tions and rinse water can be reused.

The machine provides a continuous straight-line, automatic work flow through the cleaning process. It prepares products for finishing operations as they come off the conveyor belt. Each washer is designed to meet the space requirements of the purchaser. Cleaning operations can be modified or changed to meet specific cleaning problems. It can be a single conveyor unit or a multiple belt operation, as shown. These latter units are designed to carry a variety of products of assorted sizes and shapes. Each belt has adjustable speeds. Different blow-off points for air drying can also be set and adjusted to the user's needs. Final drying is by steam, electricity, gas or any combination of these.

The machine is said, by the manufacturer, to have a potential for the cleaning of stainless steel and aluminum parts, for electronic and automotive components, and other applications requiring a spotless or bright finish on a product. *Stoelting Brothers Co.*

*Circle 48 on postcard for more data*

#### Ring and Circle Shear Has Floating Circle Arm

D EIGNED to produce commercially perfect circles, a new ring and circle shear is now being manufactured. Featured is the self-compensating circle arm which floats on guided ways to maintain a true center automatically. Adjustments for variations in thickness of material, overlap of cutters and diameter of circle are said to be eliminated.

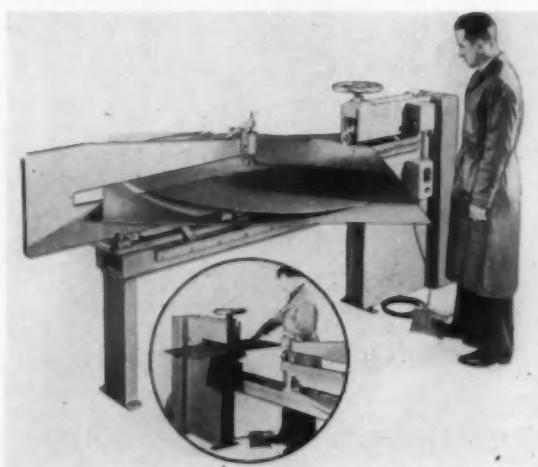
With a scale provided for con-

venient set-up, an adjustable crank enables quick positioning of the circle arm for cutting circles of various diameters. Actuated by a quick-acting cam lever, the center clamp of the circle arm is adjustable to hold varying thicknesses of material. The shear can be used for cutting both straight line work and irregular outlines (not requiring sharp curvatures), as well as for cutting circles,

circular holes and rings. With a capacity of 10 gage mild steel, it cuts circles from 6 thru 78 in. diam.

Raising and lowering the upper cutter are facilitated by a convenient hand wheel, which permits the cutting operation to be started at any point on the blank. High carbon, high chrome steel cutters are used. Both an adjustable swinging gage for centering unmarked blanks and an adjustable straight slitting gage are furnished as standard equipment. *Niagara Machine & Tool Works.*

*Circle 49 on postcard for more data*



*Niagara No. 31-RC ring and circle shear features a floating circle arm for greater accuracy in cutting circles, circular holes, rings and irregular outlines*

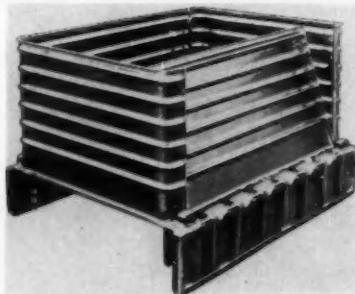
#### Hot Spray Control

H OT spray heaters are now available with an external dial temperature controller, called the Viscomatic, that is adjustable to dial any desired temperature in the 90 to 170 F range. The sensing element of the controller reads fluid temperature; and the selected temperature is automatically maintained within plus or minus two degrees, it is said. The controller, reported to be explosion-proof, is factory installed with the required heater. *Spee-Flo Co.*

*Circle 50 on postcard for more data*

## Fold-Away Box

ELIMINATING up to 66 per cent of the space needed to store and ship empty boxes, a new "fold-away" materials handling box which can be reduced to one-fifth of its original size has been developed. Made of corrugated steel, the box has collapsible sides which are easily set up or folded down. The sides are locked by a pin and slide bolt arrangement, giving the box a rigidity which permits it to be used in the same way



Republic fold-away materials handling box

as a non-collapsible box. The unit can be tiered when loaded, unloaded or folded. It has no removable parts.

While suited to handling materials such as automotive, machinery, and electrical parts, it can also be used for bulk handling or shipping of materials. The box is made in various widths, heights and lengths and can be designed for two or four-way fork truck entry. *Pressed Steel Div., Republic Steel Corp.*

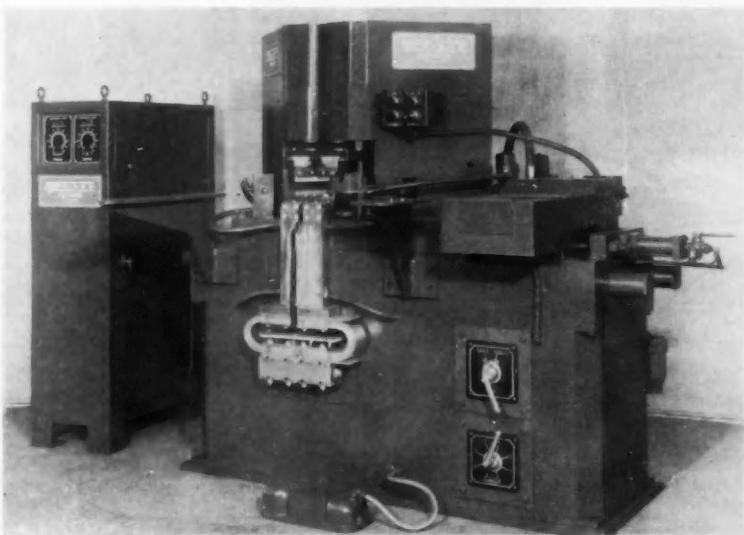
Circle 51 on postcard for more data

## Finishing Material

COMBINING a fine, fast-cutting abrasive with surface active agents designed to keep the media bright and sharp, an alkaline material for the barrel deburring of small parts is now being offered. Known as Oakite FM 183, its use, alone or with stones, is said to eliminate in many cases individual handling of parts, hand filing and abrasive belt operations. In concentrations of one to five ounces per gallon of water, it can be used for the deburring of stamped or machined parts, grinding off of sharp edges, removing tarnish, rust and heat scale, improving surface finishes, and for deburring steel and zinc, the announcement states. *Oakite Products, Inc.*

Circle 52 on postcard for more data

## Automobile Door Frames Flash-Butt Welded

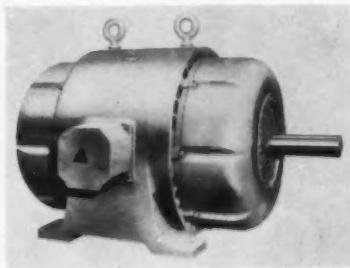


This new design of a standard, air-operated, single-phase flash-butt welding unit is being used to flash-butt automobile door frames. It is the BRO 2-45-75-90 deg machine, rated 75 kva at 50 per cent duty cycle, with direct-acting rockerarm clamping system and designed for miter joint welding. The piece is of roll-formed low carbon steel. Two welds are required, each weld in the form of a corner miter joint. Flashing and upsetting time is approximately 5½ sec for each weld joint. The present production rate is said to be close to 250 welds per hour. (Sciaky Bros., Inc.)

Circle 53 on postcard for more data

## Fan-Cooled Motor

FEATURING a unique double-end ventilation system, a new type of totally-enclosed, fan-cooled motor in the size range from 50 to 200 hp has been announced. The design employs



Delco fan-cooled motor

two external cooling fans, one at each end, which draw cool, fresh air across each bearing, then drive it the length of the motor through large cooling tunnels cast in the walls of the main frame. The fans are designed to direct the air onto the bearing housing with considerable force for scrubbing away heat and main-

taining uniformly cool bearing temperatures. The large, non-clogging tunnels, being integral with the frame walls, provide efficient heat transfer to the air stream. In addition, each tunnel has a longitudinal fin to smooth out air flow and provide extra radiating surface. Each fan handles only half the air volume required, and since air passages are generous in size, the new motor is said to be notably quiet in operation. A deflector at the end of each air passage directs the discharge air away from the cool air intake.

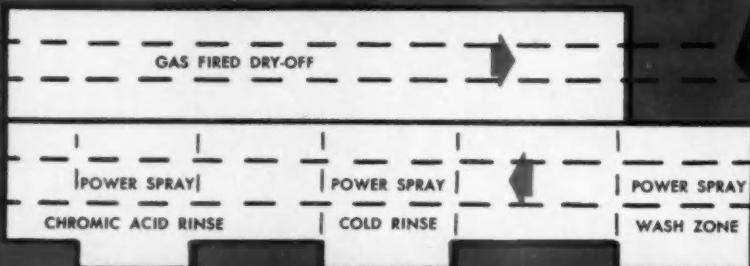
Slot cell insulation is Mylar, bonded to high quality electrical paper. The stator, after winding, is insulated with Delcote insulation, a combination of high-quality insulating varnish and cotton fiber flock which penetrates the winding, seals off the slots from dirt and moisture and reportedly gives the stator high moisture and abrasion resistance and mechanical strength.

The motor is available in a wide range of speeds and in ratings from 50 to 200 hp, with larger sizes on special order. *Delco Products Div., General Motors Corp.*

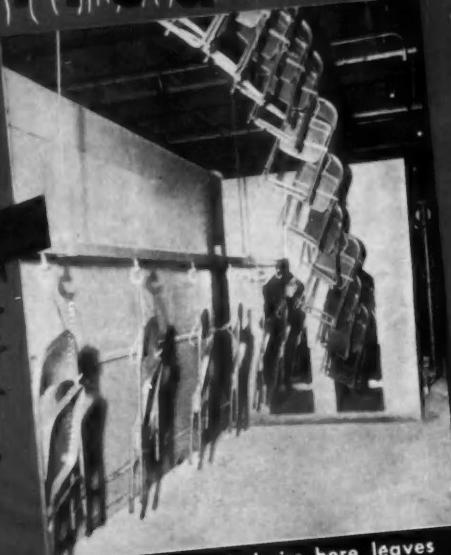
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# Washed and Dried

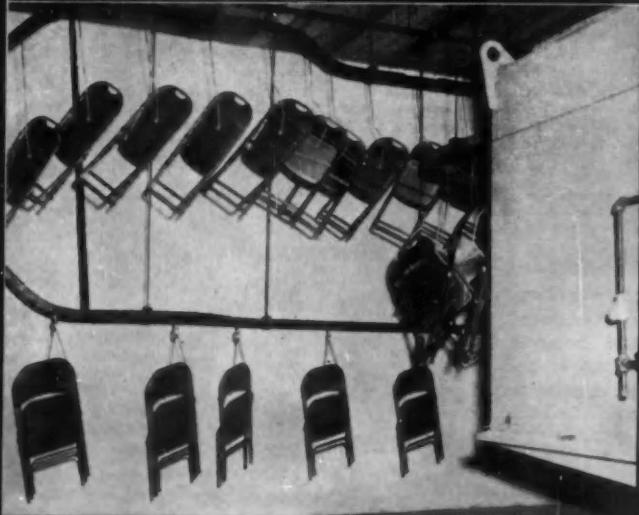
## — PREPARED for Painting



Double line of chairs leaving 3-stage Power Spray Washer. The solution tank capacity is 3600 gallons. Tank temperature is maintained at 160° to 180° F. The conveyor operates at a speed of 15 feet per minute.



Double line of chairs here leaves the gas fired dry-off at the rate of 1200 pieces per hour. The dry-off temperature is maintained at 350° F.



To meet the needs of an eastern manufacturer, Peters-Dalton designed, fabricated and installed this 3-stage double line monorail type Power Spray Washer System. Tailormade for the job, it was carefully laid out to conserve valuable manufacturing floor space. As illustrated, metal chairs are conveyed through power spray wash zone, power spray cold rinse and power spray chromic acid rinse — following which the dual monorail conveyors carry the chairs through the gas fired dry-off at the rate of 1200 pieces per hour. Here is efficiency indeed.

## PETERS-DALTON POWER SPRAY WASHER SPEEDS PRODUCTION

Whatever your specifications . . . whether for a single stage spray booth or multiple stage systems for cleaning and finishing operations . . . depend on the more than 25 years of Peters-Dalton know-how. P-D engineers can, at lowest cost, from design . . . to fabrication . . . to installation, insure the proper cleaning and surface treatment you should have for your products.

Let us know your needs. Just write, wire or phone — we'll be glad to tell you more.

Representatives in principal cities.



**Peters-Dalton INC.**  
A SUBSIDIARY OF DETROIT DRYER CO.  
17930 Ryan Road • Detroit 12, Michigan

- P<sub>1</sub>** Hydro-Whirl Paint Spray Booths
- P<sub>2</sub>** Industrial Washing Equipment
- P<sub>3</sub>** Drying and Baking Ovens
- P<sub>4</sub>** Hydro-Whirl Dust Collecting Systems

# Free INFORMATION SERVICE

Use either of these postcards for Free Literature listed below, or for more information on New Production Equipment and New Products described in this issue.

USE THIS POSTCARD

## FREE LITERATURE

### Plug Gages

Circular 595, four pages, supplies information on reversible plug gages, including standard sizes and specifications. *Pratt & Whitney Co., Inc.*

### Powder Cutting

A four-page data folder provides data on the application of iron powder processes in cutting, scarfing, gouging, lancing and washing. *Hoeganaes Sponge Iron Corp.*

### Lubricators

Automatic, cyclic-type lubricators, which provide metered oil feed by a simple mechanical drive from the machines they lubricate, are described in Bulletin 3-B, four pages, offered by *Bijur Lubricating Corp.*

### Marking Machine

The No. 201 high-speed unit for marking cylindrical or cone-shaped parts, which operates at a rate from 6000 to 7000 marked parts per hour, is described in a four-page brochure issued by *Jas. H. Matthews & Co.*

### Plastic Laminates

Catalog 1933, eight pages, describes and illustrates a complete line of new industrial and decorative plastic laminates and includes data on base materials, binders, sizes and fabricating qualities. *Plastics Div., Farley & Loetscher Mfg. Co.*

### Flexible Pipe

Catalog 708B gives the characteristics of flexible pipe nipples used to connect air or gas lines to industrial oil or gas burners. *Hauck Manufacturing Co.*

### Testing Instruments

Leaflet P-560 describes and illustrates instruments used for testing plastics, textiles, light metals and other materials. *Thwing-Albert Instrument Co.*

### Molding Machine

Bulletin 624, six pages, gives the operating features and specifications of a preplasticizing-type, plastics injection molding machine, and includes information on machine speeds and die space dimensions. *Watson-Stillman Press Div., Farrel-Birmingham Co., Inc.*

### Tracing Template

A tracing template that covers over 300 standard component parts for jigs and fixtures is being offered by *Northwestern Tool & Engineering Co.*

### Surface Measurement

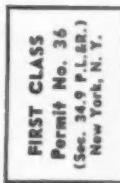
Catalog 156 covers a line of equipment for measuring surface roughness, including the recording of microinch roughness readings. *Micrometrical Manufacturing Co.*

(Please turn page)

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**Welding Directory 11**

Bulletin SB-1351 entitled "Welding Directory for Mild Steel and Low-Alloy High-Tensile Steels" provides a description of various electrodes, recommended welding procedures, and a list of applications for each electrode, in a revised edition. *Lincoln Electric Co.*

**Power Take-Offs 12**

Bulletin 308, eight pages, covers friction power take-offs for internal combustion engine applications, ranging from 95 to 602 hp in capacity. *Twin Disc Clutch Co.*

**Electric Plants 13**

Eight-page catalog A-428 describes electric generating plants, including one and two-cylinder, air-cooled models; four, six and eight-cylinder water-cooled models; and air-cooled Diesel models. *D. W. Onan & Sons, Inc.*

**Carbide Dies 14**

A 48-page booklet provides detailed information on various applications of a line of carbide dies, as well as general information on performance characteristics and maintenance. *Oberg Manufacturing Co., Inc.*

**Exhaust Purifier 15**

A report on the effectiveness of a catalytic exhaust purifier in cleaning up the carbon monoxide, aldehydes, odors and hydrocarbons found in the exhaust stream of a lift truck powered with LP-gas has been published by *Oxy-Catalyst, Inc.*

**Subminiature Switches 16**

Catalog 75a, 16 pages, contains information on a line of subminiature switches, including new completely sealed environment-free subminiature switches and actuators, illuminated push-button assemblies, and sealed, multi-circuit toggle switch assemblies. *Micro Switch Div., Minneapolis-Honeywell Regulator Co.*

**Testing Controls 17**

Bulletin MSP-133, 20 pages, describes a line of precision electrical and electronic automatic control equipment which is designed for use in aeronautical testing. Typical applications include the control of surge, altitude, and mass flow in various types of wind tunnels. *Hagan Corp.*

**Crane Equipment 18**

Bulletin E-156 describes electrical equipment for cranes and monorail systems, including copper wire, bar, T-bar, and enclosed conductors. *Industrial Crane & Hoist Corp.*

**Beryllium Copper 19**

An eight-page catalog describes the methods and procedures used to heat treat beryllium copper wrought and casting alloys. Also included is information on fixtures, furnaces, annealing methods, cleaning and brightening. *Beryllium Corp.*

**Carbon Graphite 20**

Bulletin 55, 12 pages, discusses Purebon, a carbon graphite especially designed for mechanical applications, which is now available in over 100 different combinations. *Pure Carbon Co.*

**Welding Steel Castings 21**

"Recommended Practice for the Welding of Steel Castings," a 40-page booklet published by the Steel Founders Society of America, is being offered by *Tempil Corp.*

**Weight Calculator**

A sheet metal weight calculator, which gives the weight per lineal foot in any size width of sheet metal, is being offered. Request on company letterhead to *Dayton Rogers Manufacturing Co., Minneapolis 7, Minn.*

**Elastomer**

The physical and chemical properties of a new synthetic known as Disogrinn, and its typical applications, are outlined in a six-page folder. Write on company letterhead to *Greer Hydraulics, Inc., New York International Airport, Jamaica 30, N. Y.*

# WHICH OF THESE TAPS COULD NEVER GET PAST HY-PRO'S ELECTRONIC ANALYZER?

A



B



**The serious defect in Tap B is invisible. But Hy-Pro's Electronic Analyzer detects all structural flaws for your protection.**

HY-PRO's amazing new Electronic Analyzer is one of the three important steps which Hy-Pro takes to insure you of 3-way *Quality Control*. These three steps are the Electronic Analyzer, advanced Heat Treating and the Micro-Hardness Tester.

Here's how the Electronic Analyzer works. A standard tap, perfect in every detail, is put in one side of the machine. The tap to be tested is put in the other side. Electronic impulses are shot through both taps and every inch of each tap is tested

as to composition, surface condition and internal structure.

The Hy-Pro Electronic Analyzer reveals every defect, including those that laboratory, production tapping and destructive tests fail to uncover!

The best part of the Hy-Pro story is that you get the benefit of these new Hy-Pro developments at no extra cost to you. Get in touch with your nearest Hy-Pro distributor or call us direct. Hy-Pro *quality-controlled* taps—products of the Tap Specialists—cost no more than ordinary taps.



**"The Tap Specialists"**

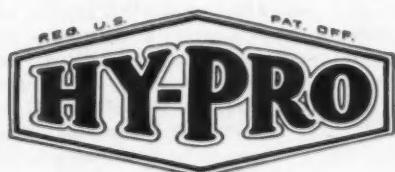
**New Bedford, Massachusetts, U. S. A.**

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# NEW

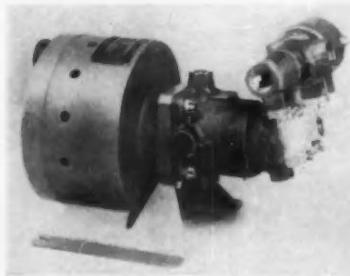
# PRODUCTS

## AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

### A-C Power Packages

Hydraulic-powered electrical power packages for air-borne installations have been developed to provide a-c power for newly designed systems and for electronic equipment added to



aircraft electrical systems. This new series, featuring light weight and improved efficiency, consists of a permanent magnet, 400-cycle type a-c generator directly driven by a flange-mounted constant-speed oil-hydraulic motor. The motor is powered by flow available in the existing aircraft hydraulic system. Speed control is within plus or minus 2½ per cent; and special configurations will maintain 400 cps frequency within plus or minus 0.1 per cent, regardless of load, it is said.

The units are currently available in six sizes for 0.5 to 3.0 kva output. Weight of the individual units is from 7 lb for the smallest package to 19 lb for the 3.0 kva output size. Larger capacity units having comparably low total weights are also available on special order. *Vickers, Inc.*

Circle 60 on postcard for more data

### Sealing Compound

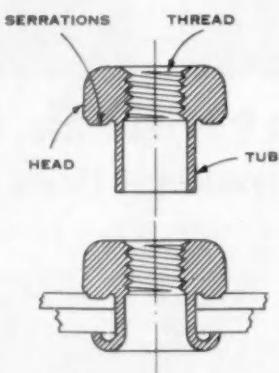
For sealing highly-corrosive liquids and solvents, a new chemically inert pipe joint compound has been developed for services up to 212 F. Known as "John Crane" Chemlon pipe joint compound, its base is Du Pont Teflon. It is said to be not only impervious to all types of hard-to-handle

fluids, but also to possess a low coefficient of friction. The non-adhesive quality of Teflon and the non-hardening characteristics of the compound allow easy disassembly of connections even after long, severe service. The compound is adaptable for use on aluminum, stainless, monel or plastic pipe. *Crane Packing Co.*

Circle 61 on postcard for more data

### Rivet-Nut Fastener

Called Perma-Nut, a new type of fastener combines the permanence of a rivet with the disassembly features of a nut. It will also hold two or more pieces (as a rivet) and fasten others by functioning as a nut. Basically, the device is a tubular rivet with a hole in the head tapped with standard threads. Radial serrations on the



underside of the head bite into the work-piece, preventing the nut from turning, once it has been clinched. It can be set automatically at production rates on conventional riveting machines.

The fastener is available in steel, brass or 5056 aluminum, in seven standard styles, with head diameters ranging from 9/32 to 13/32-in. Illustrated is the Perma-Nut before setting and after setting with a roll clinch. *Tubular Rivet & Stud Co.*

Circle 62 on postcard for more data

### Power Brake System

Announcement has been made of a dual compensating power brake system for trucks which provides for a divided hydraulic system that separates front and rear brakes. If either set of brakes fail, the other is still operative and can bring the vehicle to a stop. The new unit is said to be designed for full compliance with the truck safety requirements now being considered by the ICC.

The system also provides for a built-in control mechanism which maintains a balance between front and rear brakes to prevent early undesirable wheel skid of the more lightly loaded axle of the vehicle. This variable distribution between front and rear brakes is said to increase maximum rates of deceleration. Added fluid capacity is another feature of the design.

The dual compensating system is engineered as a remote unit and can be mounted wherever space is available. A smaller version embodying the same principles will also be obtainable for passenger cars. *Kelsey-Hayes Wheel Co.*

Circle 63 on postcard for more data

### Silicone Coating

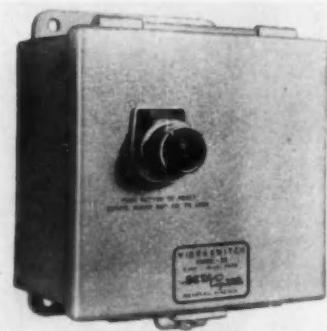
A silicone rubber cloth coating compound for ducting which can carry air at temperatures as high as 700 F and remain flexible at -120 F has been added to a standard product list. Designated SE-701, this compound is of interest for such applications as hot air ducts, jet engine starter hose, flexible connectors for metal ducting, and aircraft fire wall seals.

In addition to its wide temperature operating range, SE-701 is said to have resistance to flow under clamps, outstanding flame retardancy, and low swell in such fluids as Skydrol 500 and 700, JP4, gasoline, MIL-o-7808, and MIL-5606. *General Electric Co.*

Circle 64 on postcard for more data

## Malfunction Switch

An acceleration and vibration responsive switch has been introduced that is said to detect malfunctions and shut down rotating equipment before costly damage occurs. Malfunctions such as failing bearings, unbalance, broken blades and bent shafts are detected from slight increases in roughness or vibration. Applications



include engine test stands, propeller test rigs, motor-generator sets and other rotating equipment. It will perform in responding to "G" loading or acceleration in load testing, and is calibrated in "G" units.

The switch is adjustable over a range of normal vibration. It is enclosed in a gasketed box with an external reset operator which may be locking or non-locking. Contact arrangements are spdt, split-contact no, or split-contact nc, rated at 7-amp up to 440-v ac. The unit is also furnished in an explosion-proof enclosure for hazardous locations. *The Beta Corp.*

Circle 65 on postcard for more data

## LP-Gas Conversion Kits

Kits now available permit a simplified conversion to LP-gas carburetion of any fork lift or industrial truck so that a mechanic can handle the job without prior training or special tools, according to an announcement. There are a total of 20 operations involved in making a conversion. Step-by-step instructions are furnished by the manufacturer.

Mounting brackets, pre-fitted to the frame of the model lift or truck to be converted, are supplied. No drilling is necessary. Each assembly includes a regulator, vacuum safety switch, hydrostatic relief valve, solenoid valve, filter, quick coupling, carburetor or carburetor adapter, and all hoses with fittings attached, cut to proper lengths and clearly labelled.

All components are approved by the Underwriters' Laboratories. *Beam Products Mfg. Co.*

Circle 66 on postcard for more data

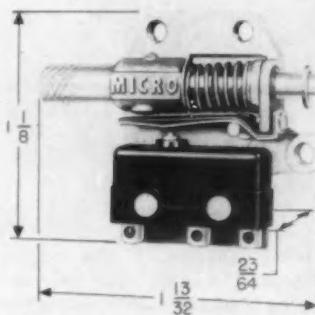
## O-Ring Material

Suitable for use with grease or oil, a new 90 durometer synthetic material has been developed for molded seals. It is adapted to service up to 300 F with MIL-L-7870A grease for lubricating aircraft instruments and MIL-L-6083 oil for preservative purposes in hydraulic equipment. The material, designated O-Ring Compound 49-091, is also recommended for use with MIL-L-7808A and MIL-L-5606 oil up to 250 F. *Parker Appliance Co.*

Circle 67 on postcard for more data

## Door Interlock Switch

For use on radio, radar and hazardous high-frequency equipment cabinets, a subminiature interlock switch is designed to cut off power automatically when a service door is opened. By pulling a rod actuator to the maintained contact position, it is possible to check circuits with the power on. The rod automatically returns to



normal position when door is closed, which eliminates the danger of "tying down" conventional switches. The basic switching element has silver contacts and a precision snap-action spring that are said to provide long mechanical and electrical life. The contact arrangement is single-pole double-throw.

The total travel, in either direction, of the actuator plunger is 5/32-in. approximately. Electrical rating of the switch, designated 7AC1-T, is 5-amp at 125 or 250-v ac; 30-v dc (inductive or resistive)—sea level 3-amp, 50,000 ft 2.5-amp, maximum inrush 15 amp. *Micro Switch Div., Minneapolis-Honeywell Regulator Co.*

Circle 68 on postcard for more data

## Bellows Tie-Rod Units

Two types of stainless steel bellows tie-rod assemblies, for use in the pneumatic ducting systems of turbojet and turboprop aircraft, are being produced for controlling thermal growth of ducting systems by absorbing relative movements between two points by angular deflections. Unlike braided bellows, they are internally restrained, and because of this type of restraint it is said the actual deflection force required is in many cases a fraction of that required with braided bellows. These assemblies are



claimed to be especially important in a tension system because they reduce the bending moments and reaction loads at mounting flanges, and column loading of the ducting.

Both assemblies are available in all diameters from 1 to 15 in. The center link or single pivot type anchors the ends of the bellows at a single point along the bellows center line. The double pivot or double link bar type employs two pivot points on the bellows center line to anchor the ends, and is capable of absorbing some lateral offset. *Arrowhead Rubber Co.*

Circle 69 on postcard for more data

## Precision Metal Strip

Because of the growing need for precision rolled thin metal strip for close-tolerance assemblies in electronic and instrument components, a company has installed facilities for rolling precious and base-metal strip to precision thickness. Thickness tolerances can be held as close as  $\pm 0.0001$  in. on strips of 0.001 in. thickness and up, according to the announcement. Maximum widths of four in. can be accommodated and after rolling, can be slit to any desired width.

Because of the special processing controls and inspection procedures necessary to provide uniformly exact thicknesses, it is emphasized that precision rolling is not offered as a standard fabrication procedure. *Handy & Harman*.

Circle 70 on postcard for more data

# News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Continued from Page 39

## High-Speed Camera Helps Find Weak Spots In Parts

A high speed camera process is helping Buick engineers locate weak spots in automatic transmission parts. The parts are placed in a "burst box" containing a 35 mm camera and spun at speeds up to 12,000 rpm until they are ripped apart by centrifugal force.

A fine screen placed around the spinning part triggers the flash inside of the darkened box as the screen is struck by the first portion of the part to break loose.

## Convair Said Ready to Launch Work on Atomic Seaplane in '57

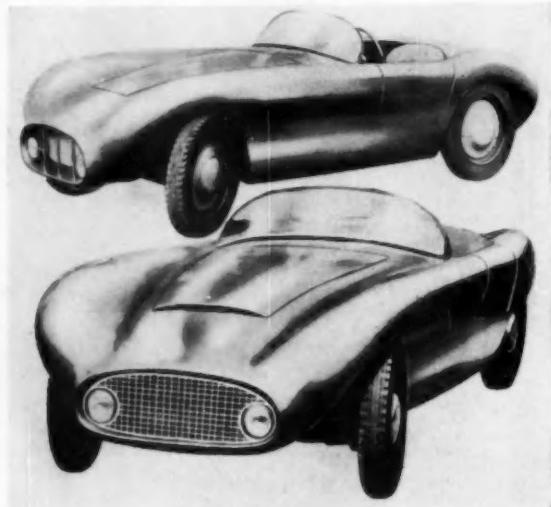
Work is expected to be started by Convair Div. of General Dynamics Corp. early in 1957 on the world's first atomic-powered seaplane. It is reported that the unique aircraft will be able to stay in the air six months.

## Savings-Stock Program Offered Chrysler Aides

Chrysler Corp. next month (August) will put into effect its first savings-stock purchase plan for salaried employees. First proposed earlier

## ATTACHABLE CAR BODIES

Two new plastic bolt-on sports car bodies are now being offered by Almquist Engineering Co. The Sabre fits such short wheelbase cars as the Crosley, Fiat, Morris Minor, etc., while the Speedster is made for cars with wheelbases of 90 to 104 in., such as the Ford, Chevrolet, Henry J., etc., it is stated.



this year (see AI, April 1, p. 34), the plan is basically the same as those now in effect at General Motors and Ford. The only slight difference is that the value is tied to the net return on sales performance of the company.

Under the Chrysler plan, the corporation will contribute 40 cents for each \$1 an employee invests in the program, if net earnings do not exceed five per cent. If net earnings fall between five per cent and seven per cent of net sales, the corporation will contribute 50 cents for every \$1 invested by the employee.

Contributions would increase to 60 cents, if net earnings exceed 7 per cent. Forty per cent of the employees' investment will go toward the purchase of Chrysler common stock and 60 per cent for Government savings bonds.

## Correction

It was erroneously stated on page 35 of the June 15 issue of AUTOMOTIVE INDUSTRIES that Chevrolet's newest automatic transmission plant is located in Cleveland. The city of Toledo, O., is its rightful home.

## SIZABLE GAINS IN NEW ENGLAND AND MIDDLE ATLANTIC STATES HOPEFUL SIGNS

### Regional Sales of New Passenger Cars

Zone	Region	April 1956	March 1956	April 1955	Four Months		Per Cent Change April over March	Per Cent Change April over April 1955	Four Months 1956 over 1955
					1956	1955			
1	New England	38,637	26,776	42,560	111,082	125,390	+38.03	-13.92	-11.65
2	Middle Atlantic	121,276	103,360	136,363	355,132	425,919	+17.34	-11.08	-16.82
3	South Atlantic	61,151	64,595	73,124	251,455	271,476	+2.25	-9.54	-7.37
4	East North Central	134,693	141,370	169,609	506,202	565,892	-5.17	-20.96	-10.55
5	East South Central	29,586	30,459	29,742	106,204	108,409	-6.76	-3.89	-2.33
6	West North Central	47,991	46,095	51,860	172,411	188,553	+3.90	-7.65	-8.56
7	West South Central	48,288	50,525	55,351	157,188	176,994	-4.43	-12.76	+5.77
8	Mountain	18,103	18,246	20,526	64,300	64,178	-0.78	-13.49	+1.19
9	Pacific	63,278	63,518	72,300	234,132	251,570	-0.38	-12.40	+6.93
Total—United States		584,272	545,234	651,855	1,936,096	2,180,371	+3.49	-13.44	-8.79

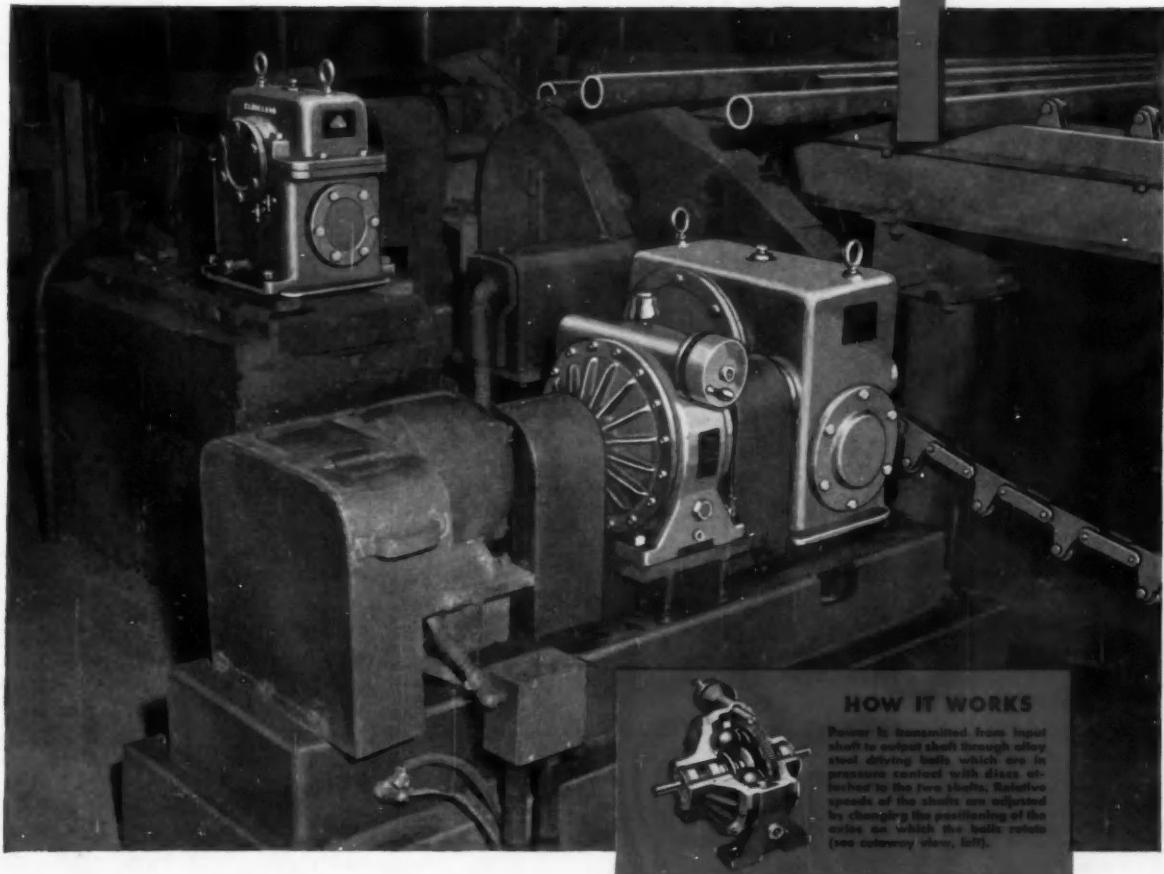
States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt., N. J., N. Y., Pa., Zone 2—Del., D. C., Fla., Ga., Md., N. C., S. C., Va., W. Va., Zone 4—Ill., Ind., Mich., Ohio, Wis., Zone 5—Ala., Ky., Miss., Tenn.

Zone 6—Iowa, Kan., Minn., Mo., Neb., N. D., S. D., Zone 7—Ark., La., Okla., Tex.

Zone 8—Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo., Zone 9—Cal., Ore., Wash.

# Hot pipe conveyor travels at precision pace set by CLEVELAND Speed Variator

Drag-type conveyors utilizing Cleveland Speed Variator Size 6K4 Series 1. Driving Cleveland Double Reduction Worm Gear Size O51D Series F, ratio 900:1.



## HOW IT WORKS

Power is transmitted from input shaft to output shaft through alloy steel driving balls which are in pressure contact with discs attached to the two shafts. Relative speeds of the shafts are adjusted by changing the positioning of the balls on which the balls rotate (see cutaway view, left).

THIS hot pipe conveyor produced by York-Gillespie Mfg. Co. is a good example of the precision engineering applied in steel mill operation today. Conveyor speed has to coincide exactly with the speed of other operations on the line—has to adjust to the pace of production anywhere in the line. That's why a Cleveland Speed Variator is on the job! Being infinitely variable, the Speed Variator gives stepless speeds over its full 9:1 range—from  $\frac{1}{3}$  to 3 times input speed. Output speed is adjusted manually by a hand wheel mounted on the Variator—but could be regulated automatically by remote controls of various types.

The Cleveland Speed Variator provides these major advantages: 1. An extremely compact unit with input and output shafts in line and rotating in the same

direction; 2. Almost any input speed up to 1800 rpm can be used—either clockwise or counterclockwise rotation; 3. Rated for constant horsepower output over a 9:1 range, or for constant output torque with a 6:1 range; 4. Infinitely variable over the entire speed range; 5. Rapid response to speed change, precise adjustment, and accurate maintenance of speed settings; 6. Long life and minimum maintenance due to absence of belts or complicated linkages; 7. Ample bearing support for overhung pulleys on either input or output shafts.

This revolutionary variable speed drive is available in eighteen standard types and sizes. For detailed description of the Cleveland Speed Variator with photographs, sectional drawings, rating tables and specifications, write for Bulletin K-200.

## THE CLEVELAND WORM AND GEAR COMPANY

Speed Variator Division, 3274 East 80th St., Cleveland 4, Ohio

Sales representatives in all major industrial markets. In Canada—Peacock Brothers Limited.

# AIR BRIEFS



By RALPH H. McCLAREN

## Looking Ahead for Civil Aviation

A General Aviation Facilities Planning Group, representing a number of national organizations active in every phase of civil aviation, except airlines, has banded together to chart civic aviation requirements for the next 10 to 20 years.

A meeting was held on June 4 in Washington, D. C., under the temporary chairmanship of George E. Haddaway of Dallas, Texas. On the executive committee with him are: Dwight P. Joyce, president of the Glidden Company of Cleveland; Dr. Leslie A. Bryan, director of the Institute of Aviation, University of Illinois, Urbana, Ill., and Dwane L. Wallace, president of Cessna Aircraft Co., Wichita, Kan. All of these men are private pilots and fly their own aircraft.

Economic and technical studies will be made to find some of the solutions to the growing air space and air traffic problems and the critical shortage of ground facilities. The group plans to report to President Eisenhower's Special Assistant for Aviation Facilities Planning, Edward P. Curtis, vice-president of the Eastman Kodak Co.

## Utility and Executive Aircraft Sales

From January to May, inclusive, this year, seven aircraft companies have shipped a total of 2990 aircraft valued at a total of almost \$45 million. Of this total 666 were shipped during May and 640 during April.

Cessna Aircraft Co. has built and shipped the greatest number of planes with Piper Aircraft Corp. second and Beech Aircraft Corp. third.

Aero Design and Engineering Co. shipped 31 of its twin engine model 560-A's and 18 of its model 680's.

## Jet Engine Overhaul

Southwest Airmotive Co., located on Love Field in Dallas, Texas, has achieved an unusual record in establishing a production overhaul job for jet engines. In five busy months after receipt of a USAF contract the trained personnel designed and built specialized shops, testing unit and conveyor lines, and installed equipment to, in that time, turn out their first overhauled jet. The jet facility occupies 100,000 sq ft of South-

west Airmotive's engine plant in Dallas. This firm has been active in the engine overhaul business for a number of years and from June, 1950, to January, 1955, they overhauled approximately 5500 engines for the United States Air Force. This activity anticipates what scheduled airlines will be doing in the next few years to establish facilities for overhauling and maintenance of their jet fleet of transport aircraft.

## New Jet Airliner

Called the Golden Arrow, a medium-range jet transport with a top cruising speed of 609 mph will be built by Convair Division of General Dynamics Corp. for TWA and Delta.

A \$200 million deal has been consummated by the Hughes Tool Co., Delta Airlines, Inc., Convair Division, and the General Electric Co. Deliveries of the jet transport are to start in late 1959. The Golden Arrow, which is so named because the exterior will be shimmering gold in color, will be powered by four General Electric jets, model CJ-805. This engine is the commercial version of the military GE J-79. Its cabin will be pressurized to maintain 8000-ft level conditions when flying "above the weather" at 35,000 ft.

Typical schedules will be something like this: Los Angeles-Chicago, 3 hours 24 minutes. Chicago-Miami, 2 hours 22 minutes. Chicago-New York, 1 hour 33 minutes. Atlanta-New York, 1 hour 36 minutes. St. Louis-Pittsburgh, 1 hour 15 minutes. Houston-Washington, 2 hours 26 minutes.

## Making the World Larger

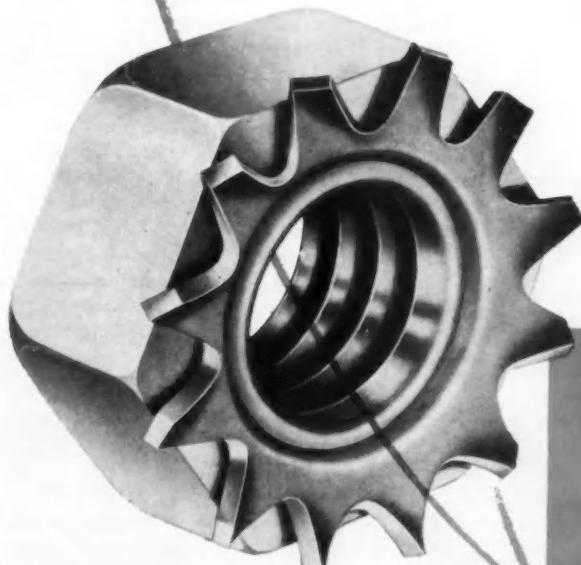
A new twist was given to the idea "airtravel shrinks the size of the globe" by William P. Lear, chairman of the board of Lear, Inc., when he recently said "use of the airplane is making the world bigger." Bill Lear was talking to a group of aviation writers in San Francisco last month and spoke of his operations in Europe. He spoke about the airplane expanding one's area of travel and, therefore, making his "world" larger.

Mr. Lear predicted a greatly expanding field in Europe for executive aircraft. He stated land travel, with congested roads, makes it almost impossible for company executives to travel from point to point. Also

(Turn to page 106, please)

# KEPS® cut costs instantly!

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you save motions, speed assembly  
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The magic of pre-assembly brings mass-assembly fastening costs down immediately! Here, in a single unit, is a famous Shakeproof Lock Washer and Nut combined into one easy to handle, vibration resistant fastener. Gone are lost lock washers, wasted man hours and expensive fastening methods. Why not take advantage of pre-assembly economy and Shakeproof ingenuity? Try KEPS . . . and save!



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# The BUSINESS PULSE

*Extent of Inventory Reduction Will Be Important in Determining Trend of Business During Third Quarter of Year. Consumer Spending and Its Effect on Investment Plans Will Also Be Critical. The Labor Market Remains Favorable.*

This Survey Is Prepared exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Company of New York.

## Markets Are Being Tested

As the economy moves into the second half of the year, it is evident that markets are in the process of being tested. Some measures of aggregate business activity — such as the Federal Reserve's seasonally adjusted index of industrial production — are already running moderately below earlier peaks, and there is considerable expectation that the third quarter of the year will witness some further letdown beyond that which is considered normal for the time of year.

At the moment, one can do little more than guess as to the course of events, although there are some indications as to the areas that will probably be of crucial importance in determining the outcome. It is, for example, clear that the extent of the fall in inventory accumulation will be of great weight. It is similarly evident that the end result will depend in important degree on how well consumer spending holds up, and whether plans for business investment will be negatively affected if consumer spending ebbs.

At present it is commonly assumed that if the decline in general business is of only moderate proportions during the third quarter, then seasonal factors of expansion this fall will be sufficient to start the economy on a new cyclical upswing, but that if there is a pronounced dip over the remainder of the summer, the economy may be in for more far-reaching adjustments. The belief that the introduction of 1957 model automobiles will provide an important expansionary nudge to general business appears to be a significant element in this judgment. For the time being such opinions regarding the outlook appear reasonable enough perhaps, although they are too intuitive in character to command universal acceptance.

On balance, recent events have tended to strengthen

the view that any near-term dip in general business is likely to be of limited proportions.

The fact that the stock-market decline which persisted through the month of May has apparently been checked is heartening, since it indicates that the tendency for confidence to ebb has been arrested. Warmer weather, moreover, appears to have brought a faster tempo of retail trade. This, if it proves to be more than temporary, will be welcome indeed, for the tendency evident in the early part of this year for retail sales to drift sidewise was discouraging. The fact that automobile sales seem to have picked up has been particularly gratifying, since the upturn appears to have checked, at least for the time being, the number of layoffs in that important industry and to have resulted in an acceleration in the reduction of automobile dealer stocks.

## Capital Spending

There have, furthermore, been some forceful reminders recently that certain strategic areas of the economy are continuing to exhibit very decided strength. Government officials, for example, have made public the results of a new survey of businessmen's investment plans (conducted in late April and May) showing that capital spending is proceeding pretty much in accordance with earlier bullish projections. With respect to the third quarter, officials reported that investment plans call for outlays of \$36.7 billion at an annual rate, almost \$2 billion above the estimated rate for the second quarter. If realized, this should compensate in large part for any slowdown that materializes in business investment in inventories. Government economists also recently issued a revised outlook estimate for total construction activity this year, placing it at \$44½ billion, whereas last November a \$44-billion total had been projected.

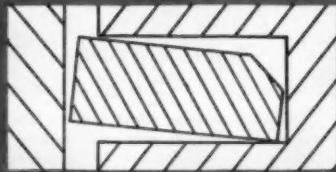
## Employment High

By and large, moreover, the complexion of the labor market remains favorable. Government statisticians report that employment experience so far this year

(Turn to page 111, please)

# It takes more than chromium to make a fine Sealed Power chrome-faced compression ring

**THE  
DESIGN  
MUST BE  
RIGHT**



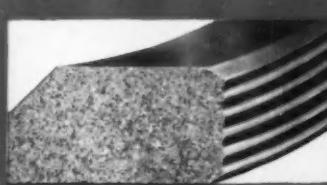
There are many different designs for Sealed Power compression rings. Each was worked out in close collaboration with the designers of the engine in which each ring is to work. Only after weeks of laboratory and actual road testing is any design released for production.

It has been truly said that no chrome-faced ring can be any better than the casting which is its foundation. Sealed Power uses a special chrome-alloy ring iron, perfected by Sealed Power metallurgists for ideal bonding quality as well as all other properties required of a good ring iron.

**THE  
PLATING  
MUST BE  
RIGHT**



**THE  
IRON  
MUST BE  
RIGHT**



Every Sealed Power chrome-faced compression ring is lapped to a light-tight finish to insure quick seating and immediate oil control—with microscopic oil-retaining grooves machined into the face of the casting to insure good lubrication in the hottest, driest location.

Electro-plating of the heavy solid chrome face on Sealed Power compression rings is done by a process devised by Sealed Power. Not only is the plating thicker than most, but it is so firmly bonded that there is not the slightest chance of chrome particles flaking off to damage the cylinder wall.

**THE  
FINISH  
MUST BE  
RIGHT**



Sealed Power Corporation • Muskegon, Michigan • St. Johns, Michigan • Rochester, Indiana • Stratford, Ontario  
Detroit Office • 7-236 General Motors Building — Phone Trinity 1-3440

## Sealed Power Piston Rings

PISTONS • CYLINDER SLEEVES

Leading Manufacturer of Automotive and Industrial Piston Rings Since 1911 • Largest Producers of  
Sealing Rings for Automatic Transmissions and Power Steering Units



Applying adhesive EC-871 to the interior of truck cabs at Diamond T Motor Car Co. This adhesive is used to bond vinyl coated jute insulating and decorative pads and fibrous glass insulation to the interior painted metal surfaces.



In picture above, vinyl coated jute is bonded to the interior back and side panels of Diamond T truck cabs. These pads are used not only to provide insulation but also a decorative appearance.

## ADHESIVES, COATINGS, AND SEALERS

### *Simplify Bus and Truck Manufacture*

MODERN adhesives, coatings and sealers, are simplifying bus and truck production problems at Mack Manufacturing Co. and Diamond T Motor Car Co. Made by the Adhesives and Coatings Division, Minnesota Mining and Manufacturing Co., these products increase vehicle operating life by providing resistance to corrosion and wear; insulate vehicles against noise, heat and cold; and

improve vehicle quality by making them weather-tight, comfortable and attractive.

In manufacturing trucks, buses, truck tractors and fire apparatus at Allentown, Pa., Mack Manufacturing Co. uses a 3M weld-through sealer to prevent water, moisture and dust from leaking in between the drip moldings and roof section. This sealer is also used to seal areas between the roof section and cab body that are joined together by welding.

Sponge rubber weather strip is bonded to cab door frames with another 3M adhesive designated as EC-524. Bus bodies are insulated against noise with EC-1189, a sound deadening coating.

Weld-through sealers are applied to the sheet metal parts before they are joined. This permits openings and voids to be sealed before welding and eliminates the need for sealing parts after the weld is made. This procedure saves time, simplifies part handling and assures a durable effective seal. These weld-through sealers do not burn out or char except at the immediate weld contact point. Thus, all potential voids between the two metal pieces are completely and permanently sealed.

Normal welding procedures are not altered by the weld-through sealers nor is weld quality reduced. The sealers withstand the effects of extreme heat, as is encountered in spot welding, without spatter-

(Turn to page 147, please)



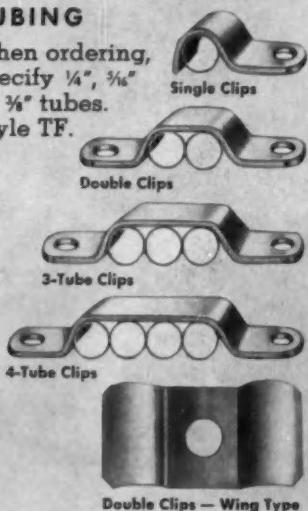
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### CLIPS FOR ATTACHING TUBING

When ordering, specify  $\frac{1}{4}$ ",  $\frac{3}{8}$ " or  $\frac{1}{2}$ " tubes.  
Style TF.



### SIGHT GRAVITY FEED OILERS

Rate of oil flow regulated by needle valve, directly observed through sight glass in stem.

Shut-off knob does not affect needle valve adjustment. Visible oil supply. Non-breakable. Tops in convenience and dependability, at low cost. Style NFU—No. 3602-A.

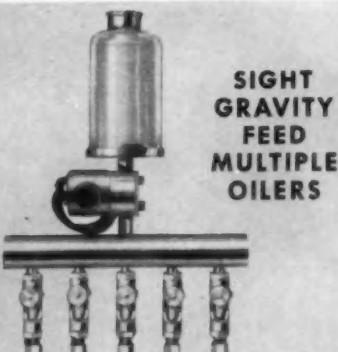
**LUBRIKIT . . .** An assortment of 95 oil cups of 29 different types. Gits sales records show these oilers are most used for replacement and maintenance. Contents of each separate bin are clearly described on Inside Cover.

Special Introductory Price  
Just \$14.95 F.O.B. Factory  
Satisfaction or your money back



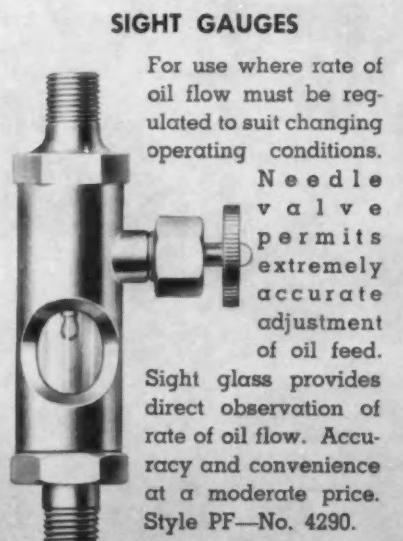
### GEAR CASE GAUGES

This oil gauge plug permits instant checking of oil level within a transmission or gear case. For use where construction permits insertion in tapped hole. A valuable addition to any such equipment—at very low cost. Style BW—No. 4042.



This one unit replaces 3 to 8 individual oilers. Maximum practicality in a small central lubrication system. Positive cut-off during idle periods. Individual vibration-proof needle valve adjustments. With solenoid control (Illustrated): Style MDS—No. 4685-A. Without solenoid: Style MD.

### SIGHT GRAVITY FEED MULTIPLE OILERS



### SIGHT GAUGES

For use where rate of oil flow must be regulated to suit changing operating conditions.

Needle valve permits extremely accurate adjustment of oil feed.

Sight glass provides direct observation of rate of oil flow. Accuracy and convenience at a moderate price. Style PF—No. 4290.

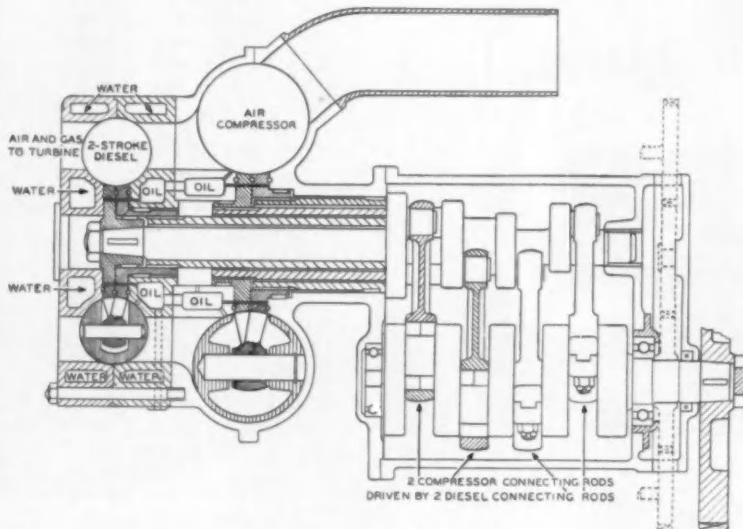
Don't price yourself out of the market. When you design proper lubrication into your equipment, specify GITS Lubricating Devices—the widest selection available anywhere. The items pictured above are only a few of our many thousands of lubricating devices. At the design stage, get the GITS story. Free Engineering Service. Send NOW for your free Catalog.

### **GITS BROS. MFG. CO.**

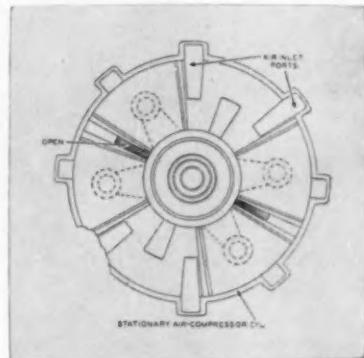
*The Standard For Industry For Almost Half A Century*

1870 South Kilbourn Avenue  
Chicago 23, Illinois

*Clip this page for handy "rough reference"*



**Details of the Bradshaw gas generator.**  
The unit shown here is rated at 60 hp.  
Outside diameter of the toroidal compressor cylinder is 17½ in., and overall height of the generator 22 in.



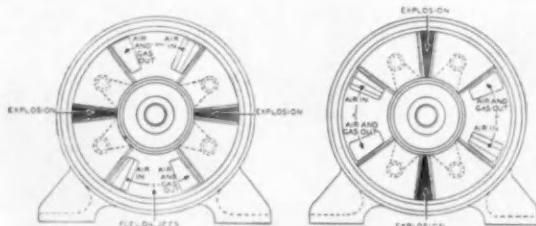
## Bradshaw Free-Piston Gas Generator

**G**RANVILLE BRADSHAW, inventor of the Omega engine described in AI of January 15, 1956, has adapted this construction based on a toroidal cylinder to a free-piston gas generator suitable for driving a power turbine. The principal advantages claimed for this design are compactness and light weight for a given output, since the large bounce pistons of the usual free-piston compressor are eliminated. In addition, the absence of periodicity in the rebound is said to permit greater speeds and flexibility of operation.

Engine and compressor are separate in the Bradshaw unit, but share a common crankshaft. The two-stroke Diesel has four double-faced curved pistons reciprocating scissor-fashion in the stationary cylinder. There are four fuel injectors, one in each quadrant. Four similarly-disposed air transfer ports from the compressor are cut in one side of the cylinder, and four exhaust ports in the other side.

Simultaneous explosions between alternate pairs of opposed piston faces drive these pistons apart. During their arcuate travel they uncover their appropriate exhaust and transfer ports, and this section of the cylinder is scavenged by air from the compressor. The hot gas and air are ducted to the turbine.

At the same time, adjacent pairs of opposed piston faces are closing in on their compression strokes. Fuel is then injected into the two combustion chambers



**By**  
**David Scott**

thus formed, and while these faces are flung apart on their power stroke, the others are moving in on compression.

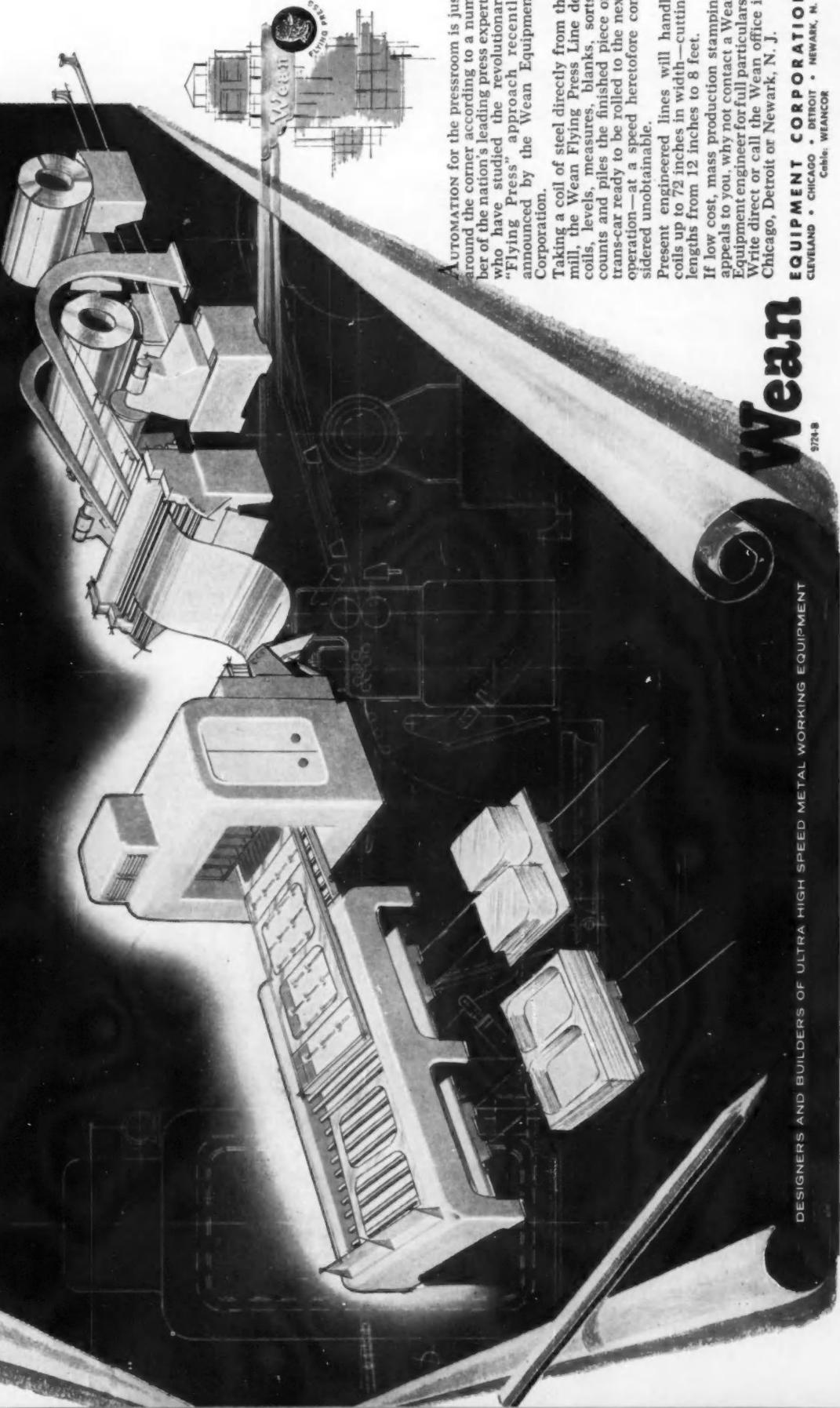
This means that the power stroke of every piston is cushioned by a Diesel compression on its reverse side, and ends with an explosion which drives the piston back. Thus special compression-return pistons are unnecessary, and the cylinder volume is fully utilized to generate gas. Heavy cast iron pistons are used, having an inertia force calculated to equal the peak explosion pressure. Because weighted pistons are floated between gas pressures, it is claimed that bearing loads caused by piston reversals are reduced by 80 per cent in both directions.

Pairs of opposite pistons are joined by connecting rods integral with a common disk, each of which is carried on one of the two inner coaxial shafts extending into the crankcase. There the shafts terminate in crank arms with a 30 deg movement, linked by connecting rods to the rotating four-throw crankshaft.

Positive mechanical phasing of the pistons is stated to permit rapid response to wide variations in throttle openings. This, together with a flywheel, reduces the

(Turn to page 126, please)

# The "NEW LOOK" in Production Stamping



AUTOMATION for the pressroom is just around the corner according to a number of the nation's leading press experts who have studied the revolutionary "Flying Press" approach recently announced by the Wean Equipment Corporation.

Taking a coil of steel directly from the mill, the Wean Flying Press Line de-coils, levels, measures, blanks, sorts, counts and piles the finished piece on trans-car ready to be rolled to the next operation—at a speed heretofore considered unobtainable.

Present engineered lines will handle coils up to 72 inches in width—cutting lengths from 12 inches to 8 feet.

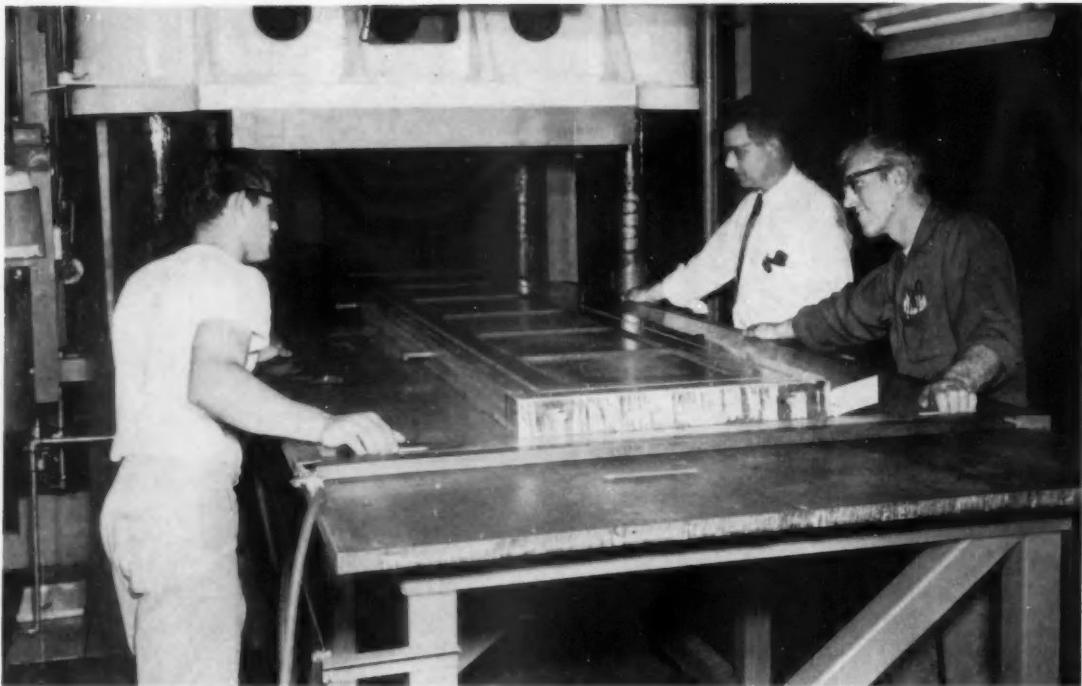
If low cost, mass production stamping appeals to you, why not contact a Wean Equipment engineer for full particulars? Write direct or call the Wean office in Chicago, Detroit or Newark, N.J.

EQUIPMENT CORPORATION  
CLEVELAND • CHICAGO • DETROIT • NEWARK, N.J.  
Cable: WEANCO

DESIGNERS AND BUILDERS OF ULTRA HIGH SPEED METAL WORKING EQUIPMENT

**Wean**

5724-B



Finger tip pressure moves 1000 lb die and table under a hydro-press at Northrop Aircraft, Inc., Hawthorne, California, plant.

## Heavy Aircraft Tooling Floats on Air Cushion

**A** TRANSFER plate and a heavy die with a combined weight of 1000 lb float on a thin cushion of air in the heavy press department of Northrop Aircraft, Inc., due to a novel application of the pneumatic principle, developed by Northrop tooling engineers.

Six evenly spaced  $\frac{1}{8}$  in. holes inject compressed air at 100 psi pressure against a hydro-press table to lift the heavy tooling plate and die. Operators can then move the die under the press with ease. Only five

pounds pressure is necessary to move the plate and die when the air is turned on.

Northrop engineers were confronted with the problem of placing rollers under the heavy press dies or devising some other means of positioning the tooling. Rollers would have to be removed before the press could be operated. A one-fifth scale model of the pneumatic device was built as a test sample. Various injection orifice positions were tested until proper balance was acquired. The model lifted 1500 lb with ease.

Flanges on the side of the magnesium tooling plate, which was used as purchased without need of machining, keep the plate in alignment with the press table.

Accurate positioning under the press may be achieved by installing automatic shut-off cams for the air supply which can be adjusted to stop the travel of the tooling plate at any point.

• • •

### Booklet Lists Hints For Young Engineers

The fourth in a series of booklets on the professional training of young graduate engineers during their first five years of employment is now available from the Engineering Society of Detroit. The booklet, entitled

"Professional Identification," discusses basically how a young engineer can develop his professional attitude and further his identification and recognition as a professional man. Copies of the booklet can be obtained from the Engineering Society of Detroit, 100 Farnsworth Ave., Detroit 2, Mich.

### Ex-Philco President Now Consultant for Chrysler

A significant move was made at Chrysler Corp., recently, with the appointment of James H. Carmine, former president of Philco Corp., as a consultant on merchandising and marketing.



3,000-ton R. D. Wood high speed forging and cogging hydraulic press. Used for forming, forcing, upsetting, impact extrusion. Handles aluminum, bronze, magnesium, steel, brass and other metals. Construction provides rigidity, plus the very accurate guiding essential in die forging and other press operations. Send for complete details of this and other R. D. Wood presses for the metal working industry.

## 150 years of excellence

This is not an empty claim. It's a fact and a challenge.

In more than 150 years of service to industry, R. D. Wood's name has never appeared on a press of inferior quality.

You can see the proof of R. D. Wood quality in the precise design, select materials, and sound craftsmanship that distinguish our presses. And you can see the results of this quality in smooth, dependable performance, increased production, economical maintenance.



**R. D. WOOD COMPANY**

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

Representatives in Principal Cities



MAKERS OF HYDRAULIC PRESS'S AND VALVES • FIRE HYDRANTS • CAST-IRON PIPE • GATE VALVES • GAS PRODUCERS • ACCUMULATORS

## AIRBRIEFS

(Continued from page 96)

that commercial air transport in Europe, particularly in the summer, is jammed to capacity by tourists. Consequently, to make appointments and attend meetings and travel on company business, the executive plane will be the answer.

### New Plane Lubricants Beat the Heat

Constantly searching for new ways

to beat the heat and stress caused by supersonic speeds in modern jets, the U. S. aircraft industry is now experimenting with high-temperature aircraft lubricants that will operate between 1000 and 2000 F—more than three times hotter than existing lubricants. The new compounds will open up entire new horizons in aircraft engine design, applying to both hydraulic and bearing systems.

Today the upper limit is around 500 F in aircraft hydraulic systems and around 350 F in bearings. Silicone fluids can take up to 700 F.

### MATS Crosses Ocean Once Every Hour

Military Air Transport Service, which marks its eighth anniversary this month, has carried approximately 3,770,000 passengers, and its planes have crossed the Pacific and Atlantic Oceans more than 93,000 times—an average of a plane an hour around the clock.

A new turboprop cargo aircraft, capable of carrying a payload of 100,000 lb for 1000 miles, is scheduled to join the MATS fleet this year.



- Husky—Heavy Duty
- Friction-Free
- Minimum Maintenance
- "Strap Drive"
- Smooth Engagement

Engineered by BORG & BECK

for that vital spot where power takes hold of the load



BORG & BECK DIVISION

BORG-WARNER CORPORATION • CHICAGO 38, ILLINOIS

### F4D Skyray Joins the Fleet

One of the Navy's most spectacular airplanes, the Douglas F4D Skyray, went into service with the U. S. Fleet in April, 1956. The Skyray presently holds the 100 kilometer closed circuit speed record of 728.11 mph.

It is now in full production at the El Segundo Division of the Douglas Aircraft Co., Inc., Santa Monica, Calif.

The Skyray weighs about 20,000 lb and is powered with a Pratt & Whitney J-57 engine with afterburner. It is basically an interceptor aircraft and is designed to attack other aircraft with guns and rockets.

### Super Strength

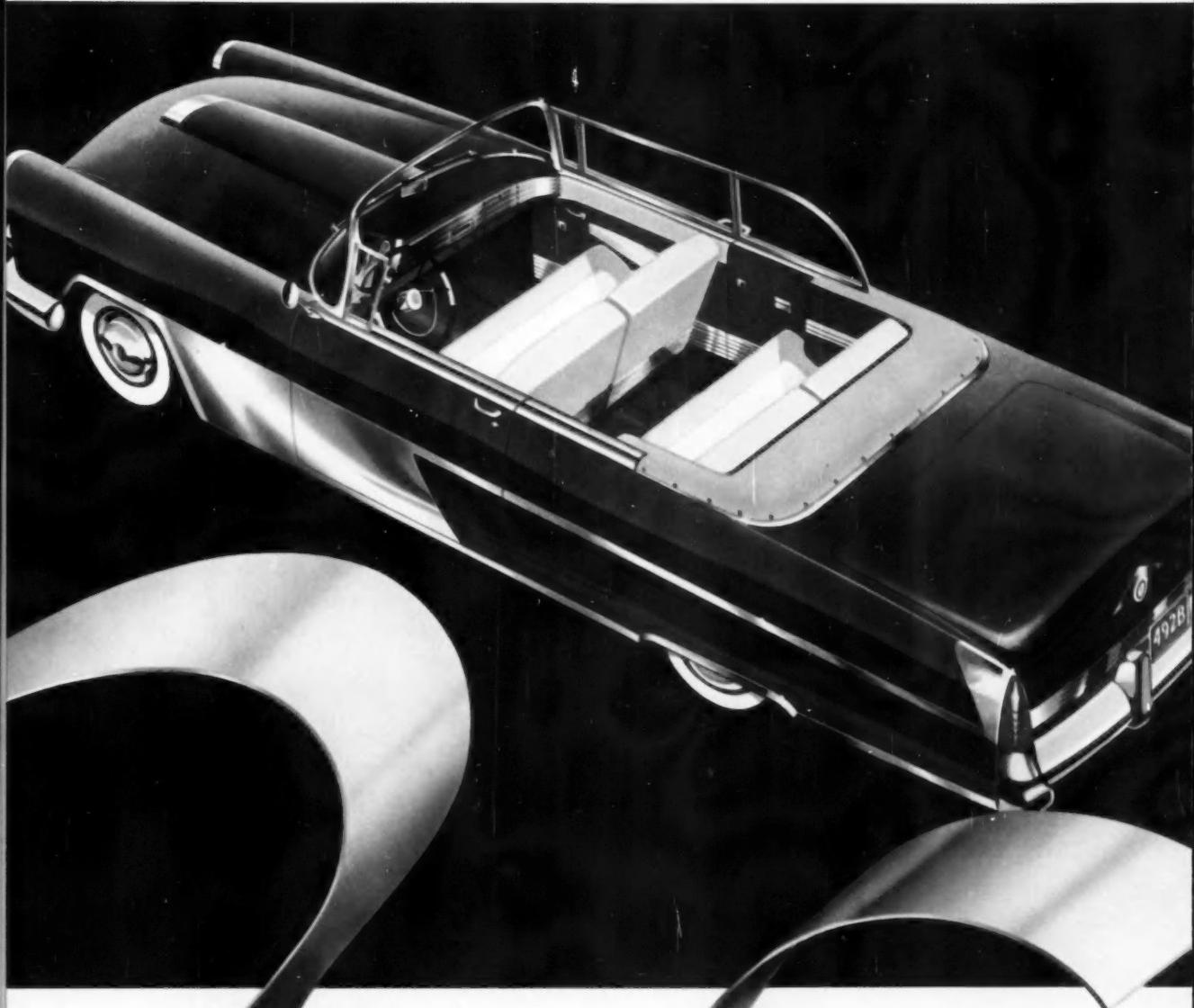
Tiny whiskers of iron have been produced with tensile strength as high as 1,900,000 psi. This is a new record for strength of metals. This strength is more than 150 times that of ordinary iron crystals and four times that of the strongest steel wire.

Production of the almost perfect iron crystals has been achieved at the General Electric Research Laboratory, Schenectady, N. Y. Dr. J. Herbert Holloman, manager of metallurgy and ceramics research for G.E., spoke of the development of the iron crystals in connection with revealing other metallurgical advances during a recent meeting of the Aviation Writers Association in San Francisco. He also spoke of molybdenum as a new candidate for the title of "wonder metal." As is well known, molybdenum has very high strength at high temperature but oxidizes very rapidly. Work at the G.E. laboratories is progressing to protect the metal from oxygen and thus utilize its high strength properties at high temperature.

AUTOMOTIVE INDUSTRIES  
KEEPS YOU INFORMED

# the bright spots

in any automobile picture



FUNCTIONAL AND

DECORATIVE TRIM OF

# stainless steel

BRIGHTWORK of time-proved *stainless steel* sparkles invitingly on the car dealer's floor . . . shines as it serves, year after year . . . gleams like new when the car is old! For built-in luster that foils corrosion, plus super-strength to resist dents and scratches, design and specify STAINLESS STEEL . . . the quality metal that speeds acceptance of your cars—on *first sale and resale!*

**Superior**

stainless strip steel

**Superior Steel**

CORPORATION

CARNEGIE, PENNSYLVANIA

*One* **TOOL DOES**  
**THE WORK OF** *Two!*

## **CP Air-Saw** **CUTS and FILES...**

**Stainless Steel, Nickel, Copper, Aluminum, Iron,  
Steel, Brass, Plastics, Plexiglass, Fiberglas,  
Porcelain, Formica, Corrugated Transite Sheeting,  
Wood, Plywood, Hard Fibre, Wall Board, Masonite.**

Use it as a saw or a file on heavy-duty production line work. Fit it with a blade and it becomes a utility saw capable of cutting practically every material and every possible shape . . . steel blade stock from your all-purpose band saw can be used for special applications. Add a file chuck and use it with round or flat shank files. Conversion takes 60 seconds. Designed with Variable Speed Control, its cutting action can be regulated to suit your work conditions. For details, write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

### **Examples of its thousand-and-one uses**

1. In Receiving and Shipping — opening wooden boxes and crates.
2. In the Shop — cutting thin gauge metal without warpage.
3. In the Foundry — deburring castings.
4. In the Automotive field — installing car heaters, radios and "extra" items.
5. In the Electrical field — armature undercutting, cutting coils out of electric motors, filing burrs from stator slots.
6. In Plant Maintenance — blind sawing in duct and piping work.



# **Chicago Pneumatic**

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

**SKF**  
makes them ALL

Because **SKF** makes ball and roller bearings of many types and sizes, **SKF** serves *all* industries.

That is why you get unbiased advice based on exceptionally *broad* experience when **SKF**'s unmatched product-assistance staff helps you put the right bearing in the right place in your product.

**SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.**  
—manufacturers of **SKF** and HESS-BRIGHT® bearings.

**SKF**

BALL AND ROLLER BEARINGS

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**IMPROVED SPHERICAL  
ROLLER BEARING...**

**#1**

Size for size, more capacity and longer life than any other spherical roller bearing. Introduced by **B&SF** two years ago; now available in the popular series. Already adopted by hundreds of leading manufacturers.



**#2**

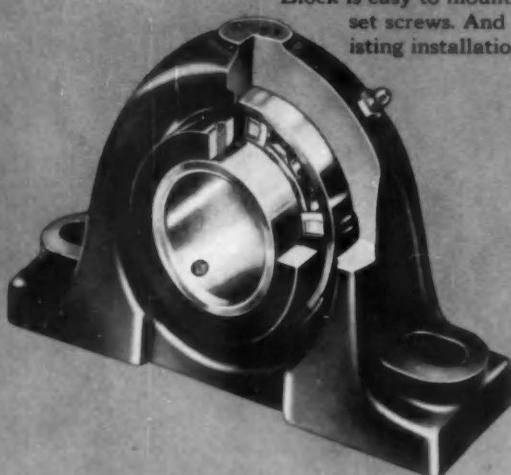
**HIGHER CAPACITY CYLINDRICAL  
ROLLER BEARING...** With crowned rollers and cylindrical raceways, engineered for today's high speed-high load applications. Available with flanged or flangeless rings to meet design requirements.



*Four of the Many*  
**SKF**  
**QUALITY PRODUCTS**

**#3 "SY" UNIT PILLOW BLOCK WITH  
SUPERIOR BEARING SEAL...**

Red Seals, of DuPont "Fairprene", team with a rotating flinger to exclude dirt and retain lubricant. The "SY" Pillow Block is easy to mount — just slide unit on shaft, tighten two set screws. And the "SY" is interchangeable with existing installations.



**#4**

**QUIETER RUNNING SINGLE-ROW  
DEEP GROOVE BALL BEARINGS...**

With proven **B&SF** Red Seals which keep dirt out and lubricant in. Available with any of 13 combinations of Red Seals, shields and snap-rings.



*To Get The Most Valuable  
Book You Ever Had...*

Catalog #350 — Complete technical and engineering data on **B&SF**'s complete anti-friction line. Send for your copy to **SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.** — manufacturers of **SKF** and **HESS-BRIGHT®** bearings.

7602-A  
FORM 410

*See idea for design engineers on other side.*

**SKF®**

**BALL AND ROLLER BEARINGS**

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## WAGNER BROTHERS

### BUSINESS PULSE

(Continued from page 98)

has been in keeping with seasonal expectations, despite the appreciable cutbacks in the automobile industry. Total employment in May was above the 65-million mark and very close to the all-time seasonal peak of 65½ million established last summer. Unemployment, moreover, at 2.6 million constituted a comparatively moderate percentage of the total civilian labor force.

There have, of course, been some less favorable developments of late. Sales weakness still seems to persist, for example, in some appliances, some textile products, farm machinery and fertilizer, and so on, occasioning price and output cuts in certain instances. Moreover, while labor-market conditions appear to be satisfactory as measured by the numbers of employed and unemployed, the average work week has continued in a downtrend. This decline of the work week is significant not only because it has an erosive effect on take-home pay but also because the average number of hours worked has tended to lead the cyclical performance of general business in past years. Thus, to some observers its continuing downturn now suggests the possibility of future cyclical weakness in business.

### Minor Business Decline

Virtually all of these unfavorable developments, however, represent the continuation of trends which had become visible earlier. None, moreover, is of the sort that makes really dramatic headlines. Hence, they have been less significant as conditioners of sentiment of late than such factors as the stronger tone of stock-market prices and the quicker pace of automobile sales. It is therefore not surprising that the net effect of recent developments has apparently been to reassure observers that any near-term decline in general business is likely to be of minor proportions.

### AUTOMOTIVE INDUSTRIES . . .

*is your News Magazine of Automotive and Aviation*

### MANUFACTURING

The advertisement features a large, rectangular "GERMANIUM POWER RECTIFIER" unit with a control panel and a circular vented area. In the foreground, a "Safety Cell" is shown, consisting of a cylindrical component with a protective housing. The text "NEW" is written in large, bold letters across the top left of the advertisement. Below the main unit, a callout box contains the text "... has 95% efficiency ... with 100% protection!"

**Germanium has no peer for use as a semiconductor in providing an efficient source of DC current. However, germanium is extremely heat sensitive and must be protected against thermal overload and current faults which, if unchecked, would instantly destroy the germanium junctions.**

After two years of research and design in collaboration with the General Electric Company, Wagner Brothers is proud to announce their new, completely protected, highly efficient Germanium Power Rectifier.

General Electric "Safety Cells" are hermetically sealed to shield the germanium element from moisture and any corrosive fumes. Each "Safety Cell" is individually protected from destructive current faults by fast-acting "amp trap" fuses which break the circuit in a fraction of a second, before the germanium junctions can be destroyed.

Further protection from normal overcurrent and undervoltage input is provided by separate breakers on the main contactor and on the blower motor. A pressure switch guards against thermal overloads in case of blower malfunction.

Now you can have the advantages of efficient germanium power rectification—plus, assurance that current faults and overheating will not cause stack burnout, downtime and expensive repairs.

If you need a dependable source of DC current, write for our portfolio of technical information.



CHICAGO  
CINCINNATI  
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INDIANAPOLIS  
NEW YORK  
ROCHESTER

*Wagner*

BROTHERS  
INCORPORATED

437 MIDLAND AVE., DETROIT 3, MICHIGAN

## More Government Contract Awards

THIS latest list of Government prime contracts that have been awarded covers the period from May 25 to June 25, 1956. Items included in this list are for various types of automotive military equipment, including tanks, motorized gun carriages, trucks, airplanes, automotive components and spare parts, automotive maintenance equipment, etc.

**AERO DESIGN AND ENGINEERING CO., Bethany, Oklahoma**  
L-26C airplanes, spare parts—4 ea.—\$452,256

**AEROQUIP CORP., Jackson, Michigan**  
Fitting end—365,000—\$156,823

**AMERICAN BOSCH ARMA CORP., Arma Div., Garden City, New York**  
Facilities in support of WS-107A program—\$710,000

**THE AMERICAN COLEMAN CO., Littleton, Colorado**  
Tractor, wheeled—55 ea.—\$381,842

**AMERICAN WELDING AND MANUFACTURING CO., Warren, Ohio**  
Facilities for engine components—\$99,000

**AVCO MANUFACTURING CORP., Advance Development Div., Stratford, Conn.**  
Facilities in support of WS-107A—\$1,075,000

**AVCO MANUFACTURING CORP., Lycoming Div., Williamsport, Pa.**  
O-435-23 engines—\$509,805  
O-480-I engines—\$545,850

**THE BAKER-RAULING CO., Cleveland, Ohio**  
Truck, forklift, electric—50 ea.—\$227,354

**BALDWIN-LIMA-HAMILTON CORP., Austin-Western Works, Aurora, Ill.**  
Motor wrecker hoist hydraulic swing assy.—272—\$71,773

**BEECH AIRCRAFT CORP., Wichita, Kansas**  
Test program on target drones—job—\$243,344

**BENDIX AVIATION CORP., Bendix Products Div., South Bend, Ind.**  
Maintenance parts for aircraft—various—\$308,062  
Brake and wheel assemblies—various—\$75,448  
Maintenance parts on carburetors—\$30,797  
Pack assy, air brake—813—\$27,910  
Parts and assys.—various—\$59,339

**BENDIX AVIATION CORP., Eclipse-Pioneer Div., Teterboro, New Jersey**  
P-1 automatic pilot components—652—\$2,062,475

**BENDIX AVIATION CORP., Red Bank Div., Eatontown, New Jersey**  
Generators, engine driven—903 ea.—\$391,769

**BOEING AIRPLANE CO., Seattle, Washington**  
Extension of flight test program—\$4,453,365  
Facilities—job—\$231,000

**BOEING AIRPLANE COMPANY, Wichita, Kansas**  
Trainers—\$33,562  
Facilities for B-52 aircraft—\$4,400,000  
Modification aircraft—job—\$2,500,000

**BORG-WARNER CORP., Rockford Illinois**  
Shaft assy., propeller—502—\$39,176

**BORG-WARNER CORP., Long Manufacturing Div., Detroit, Michigan**  
Modification kits—4188 ea.—\$29,965

**BORG-WARNER CORP., Pescos Products Div., Bedford, Ohio**  
Pump accessories—22 items—\$46,609

**CARTER CARBURETOR CORP., St. Louis, Missouri**  
Pump, fuel assy.—6564—\$85,660  
(Turn to page 114, please)



### TUNG-SOL<sup>®</sup> SIGNAL FLASHERS



### The "Blink" and the "Tick" Spell Safety

Of all the signals devised for general automotive use, nothing is so commanding, so safe as the flashing light. . . . And the heart of these signal systems is the Tung-Sol Flasher.

In addition to the blinking action, the Tung-Sol Flasher provides for an instrument panel pilot light. This, plus an audible "tick-tick-tick", doubly assures the driver his signals are working.

The fact that the Flasher normally lasts the life of the car is indicative of the complete dependability which characterizes all products manufactured by Tung-Sol, a pioneer in auto lamp engineering since the turn of the century.

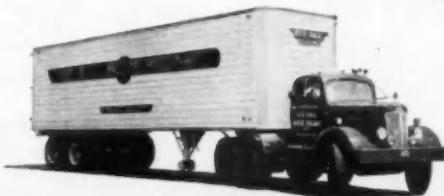
**TUNG-SOL ELECTRIC INC., NEWARK 4, N. J.**

#### Sales Offices

Atlanta, Columbus, Culver City, Dallas, Denver, Detroit, Melrose Park (Ill.), Newark, Philadelphia, Seattle, Canada: Montreal.



**It pays to equip your trucks with the Air  
Brakes America's Leading Fleet Operators prefer  
BENDIX-WESTINGHOUSE**



"During our 27 years in business  
**We've bought 1,611 trucks**  
AND WHEN IT COMES TO AIR BRAKES, WE PREFER  
**Bendix-Westinghouse!**"

THE WORLD'S MOST TRIED AND TRUSTED AIR BRAKES

MR. HENRY E. ENGLISH  
Chairman of the Board  
Red Bull Motor Freight, Inc.

From general headquarters in Dallas, Texas, Mr. English, a past president of A.T.A., directs one of the nation's leading less-than-truckload operations. Employing over 825 people and maintaining 46 terminals, this company operates nearly 900 trucks, tractors and semi-trailers which rolled up a total of over 11,000,000 miles last year. The company's 1000 miles of certificated routes stretch from Amarillo, Texas, and Texarkana, Texas-Arkansas, in the Northwest and Northeast to Fort Worth, Texas, in the West, Shreveport, Louisiana, in the East and Houston, Texas, in the South.

"In our 33 years of business

**We've bought 2,000 trucks**  
AND WHEN IT COMES TO AIR BRAKES, WE PREFER  
**Bendix-Westinghouse!**"

THE WORLD'S MOST TRIED AND TRUSTED AIR BRAKES

MR. MILTON J. ZABARSKY, Treasurer,  
St. Johnsbury Trucking Co., Inc.

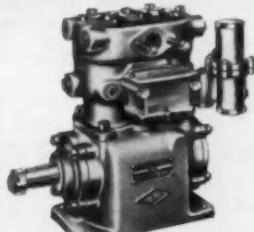
From his company's modern general office and terminal building, located in Cambridge, Massachusetts, Mr. Zabarsky helps direct one of the best-known trucking companies in the northeastern United States. This large, experienced firm serves shippers and receivers throughout New England, New York City and metropolitan area, and northern New Jersey. St. Johnsbury Trucking Company maintains 22 terminals, employs nearly 900 people and last year rolled up total mileage of over 8,000,000 miles.



It is a rarity, indeed, when a product in any field demonstrates customer preference so strong that it continually outsells all other competition combined year after year. Yet, for the past twenty-five years this has been the remarkable accomplishment of Bendix-Westinghouse Air Brakes in the truck and bus fields! In fact, recognition of the greater safety, economy and dependability of Bendix-Westinghouse Air Brakes by truck buyers has

resulted in their factory installation on more and more truck models of all sizes.

Chances are good that your trucks, too, offer the many advantages of these powerful brakes. If not, we suggest you take advantage of the proven preference and superiority of Bendix-Westinghouse Air Brakes by offering them as factory-installed equipment. It's one sure and easy way to add more sales appeal to your vehicles!



Over 1,500,000 compressors produced over a twenty-five-year span stand behind the TU-FLO 400. Many advanced features guarantee performance no other compressor can equal.

**Bendix-Westinghouse**



**AIR BRAKES**

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE COMPANY • General offices and factory—Elyria, Ohio. Branches—Berkeley, Calif. and Oklahoma City, Okla.

# Saves 40% Space! STRONGER, TOO

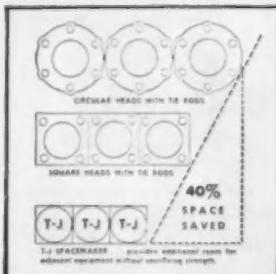
Than Outmoded  
Tie Rod Cylinders!



## Spacemaker CYLINDERS

Offer All The Extras As Standard!

- NEW exclusive Ingenious Cushion Designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion
- Compact design eliminates tie rods, saves up to 40% space
- Proven Performance . . . with Extra High Safety Factor
- Hard Chrome Plated Bodies and Piston Rods (Standard, at no extra cost)
- Oil pressure up to 750—AIR to 200 P.S.I.



You'll find many answers to *automation* in your plant with T-J Spacemaker Cylinders! Designed with years-ahead features for top performance and dependability. Wide range of styles, capacities . . . for all kinds of push-pull-lift operations . . . reduces man-hours and costs! Write The Tomkins-Johnson Co., Jackson, Michigan.

MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

**T-J**  
**TOMKINS-JOHNSON**  
DISTRIBUTORS...AIR AND HYDRAULIC CYLINDERS, CUTTERS, CLINCHERS

NEW LITERATURE . . . send today  
for new Bulletin with complete  
details of Spacemaker line.

(Continued from page 112)

### CATERPILLAR TRACTOR CO., Peoria, Illinois

Tractor, wheeled, 4x2, 14,000 to 20,025 lb  
DBP—21 ea.—\$470,453  
Engine generator sets, 60-KW—4 ea.—  
\$46,389

### CHAMPION SPARK PLUG CO., Toledo, Ohio

Spark plugs—various—\$1,100,161

### CLARK EQUIPMENT CO., Special Development Section, Battle Creek, Michigan

Production of two forklift trucks—job—  
\$93,189

### CLARK EQUIPMENT COMPANY, Buchanan, Michigan

Truck, forklift, gasoline—25 ea.—\$431,840

### CLARK EQUIPMENT CO., Jackson, Mich.

Repair parts for forklift truck—26 items—  
\$39,085  
Spare parts for forklift truck—14 items—  
\$73,355

### CONSOLIDATED DIESEL ELECTRIC CORP., Stamford, Conn.

Multi-purpose servicing vehicle—  
\$6,615,690

### CONTINENTAL AVIATION & ENGINEERING CORP., Detroit, Mich.

Compressor, air gas turbine—200 ea.—  
\$5,121,974  
J69-T-19A engines A2K-0201—\$3,081,582  
Engine spare parts—167—\$86,127  
Design, development, engines—\$315,423

### CONTINENTAL MOTORS CORP., Detroit, Michigan

Engine-generator sets—job—\$73,943

### CONTINENTAL MOTORS CORP., Muskegon, Michigan

Repair of engine—350 ea.—\$326,409  
Engines—\$459,712  
Engine spare parts—22,475—\$178,601  
Engineering services—job—\$1,007,900  
Automotive spare parts—1742 and 1 lot—  
\$341,450

### CURTISS-WRIGHT CORP., Propeller Div., Caldwell, New Jersey

Propeller assy.—153—\$8,649,516

### CURTISS-WRIGHT CORP., Wright Aero-nautical Div., Wood-Ridge, N.J.

A1J3002 J-65-W engine—\$19,140,000  
Rework of blades, rotor, turbine—230,969  
ea.—\$327,975

### DANA CORPORATION, Toledo, Ohio

Shaft assembly, propeller—\$126,795

### DOUBLE A PRODUCTS CO., Manchester, Mich.

Auto spare parts—471 ea.—\$38,725

### DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif.

Spare parts—job—\$331,033  
Facilities in support of the WS-315A program—\$2,026,000  
Yoke assys.—80 ea.—\$29,527  
Replenishment parts—job—\$266,300

### THE ELECTRIC AUTO-LITE CO., Toledo, Ohio

Spark plugs—530,125—\$295,562  
Armature, starter—\$31,857

### ELECTRO-MECHANICAL PRODUCTS CO., Garden City, Michigan

Tank spare parts—2219 ea.—\$611,889

### EX-CELL-O CORPORATION, Lima, Ohio

Facilities for engine components—  
\$1,785,000

(Turn to page 116, please)

# NEW

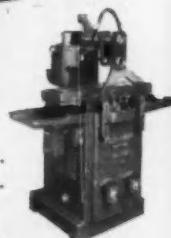


No. 3-36 . . . 16" table travel  
... 64" x 16" table . . . full  
automatic hydraulic feed.

**Simple . . .  
Rugged . . . Efficient**



No. 2-20DS . . .  
Double Spindle  
for two milling  
operations . . . 20"  
table travel . . .  
42" x 12" table.  
Hydraulic feed.



No. 1-14 . . . 14"  
table travel . . .  
32" x 9" table . . .  
hydraulic table  
feed . . . full auto-  
matic cycle.



No. 2-20 . . .  
20" table travel  
... 42" x 12"  
table . . . full  
automatic hy-  
draulic feed.



No. 1-M . . . Hand  
feed to table and  
head . . . 25" x 9"  
table . . . 12" table  
travel . . . head  
counter-balance is  
adjustable.

## No. 3-36

### HYDRAULIC MILLING MACHINE

Now—the family of Kent-Owens Milling Machines has expanded to give you the same unexcelled milling accuracy, speed and dependability for larger size work!

Proudly we present the No. 3-36 Hydraulic Milling Machine . . . the new "big brother" in the line of popular Kent-Owens Millers. Each Kent-Owens machine is ruggedly designed with advanced features throughout for greater dependability and accuracy to maintain tough production schedules. Write for bulletin 955 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines.

Kent-Owens Machine Co., Toledo, O.

*Call on*

# KENT-OWENS

for MILLING MACHINES

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GENERAL OFFICES OF KENT-  
OWENS CO.

Boulder Mountain Mfg. Co.

CASE AGCO  
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DALLAS  
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DETROIT  
C. M. Cottrell Mfg. Co.

DETROIT  
G. V. Heppenstall Mfg. Co.

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GRANVILLE APPLS  
Troyer Brothers

H. W. ELLIOTT  
John H. Elliott Co.

HARTFORD  
Hartford Machine Tools

HIBBON  
Oliver H. Hibbont Co., Inc.

INDIANAPOLIS  
G. L. Morris Co.

KANSAS CITY  
Dowling Machinery Co.

LAWRENCE  
Lindberg Co.

LOS ANGELES  
W. C. Young Co.

MILWAUKEE  
J. C. Young Co.

MINNEAPOLIS  
John H. Hibbont Co.

MINNEAPOLIS  
The Standard Machine Co.

MONROVIA  
John H. Hibbont Co.

NEW ORLEANS  
John H. Hibbont Co.

NEW YORK  
Hannington-Wilcox-Brown  
Corporation

PHILADELPHIA  
General Manufacturing Co.

PORTLAND, ORE.  
John H. Hibbont Co.

RIDGEFIELD, CONN.  
John H. Hibbont Co.

ST. LOUIS  
John H. Hibbont Co.

ST. PAUL  
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John H. Hibbont Co.

WICHITA, KAN.  
John H. Hibbont Co.

WINSTON-SALEM,  
N.C.  
John H. Hibbont Co.

WILMINGTON, DEL.  
John H. Hibbont Co.

WILKES-BARRE,  
PA.  
John H. Hibbont Co.

(Continued from page 114)

**FAIRCHILD ENGINE & AIRPLANE CORP.**,  
Stratos Div., Bay Shore, Long Island,  
New York  
Modification of B-47 refrigeration packages—job—\$221,400

**FARGO MOTOR CORP.**, Washington, D.C.  
Trucks—808—\$1,705,798

**FARGO MOTOR CORP.**, Highland Park,  
Michigan  
Gasoline trucks—26 ea.—\$39,036  
Automobile, ambulance—16 ea.—\$71,363

**FASCO IND., INC.**, Rochester, New York  
Switch assy., stop light—48,528 ea.—  
\$41,200

**FIRESTONE TIRE AND RUBBER CO.**, Los Angeles, Calif.  
Tires, truck—1434 ea.—\$50,491

**THE FIRESTONE TIRE & RUBBER CO.**, Akron, Ohio  
Tire, 6.00 x 16—6967 ea.—\$89,316

**FLETTNER AIRCRAFT CORP.**, Kew Gardens, New York  
Flying crane helicopter—job—\$39,646

**FOOD MACHINERY AND CHEMICAL CORP.**, San Jose, Calif.  
Vehicle engineering services — various —  
\$1,031,000  
Vehicle, armored—various—\$59,501  
Motor, SP, full tracked—120 ea.—  
\$3,713,880

**FORD MOTOR CO.**, Ford Div., Washington, D. C.  
Trucks—27—\$71,313

Station wagons—12 ea.—\$19,472  
Automobiles—12 ea.—\$17,612

**FORD MOTOR COMPANY**, Dearborn, Michigan  
Implementation for production of turbojet aircraft engines—job—\$9,000,000

Development, engineering, automatic gun—\$74,250

**FRUEHAUF TRAILER CO.**, Detroit, Michigan  
M24 trailer—3 ea.—\$50,352

**GENERAL DYNAMICS CORP.**, Convair Div., Ft. Worth, Texas  
Additional facilities in support of B-58 program—\$3,526,000  
Facilities in support of WS-125-A program—\$7,500,000

**GENERAL DYNAMICS CORP.**, Convair Div., San Diego, Calif.  
Assys. and parts for R4Y-1 A/C—various —\$46,001  
Facilities in support of WS-107A program—\$7,815,000

**GENERAL ELECTRIC CO.**, Syracuse, New York  
Facilities in support of WS-107A program—\$1,308,000

**GENERAL ELECTRIC CO.**, Evendale, Ohio  
Construction and acquisition of facilities for aircraft propulsion development—\$5,157,702

**GENERAL ELECTRIC CO.**, Erie, Pa.  
Generators, aircraft engine driven—\$391,267

**GENERAL MOTORS CORP.**, AC Spark Plug Div., Flint, Michigan  
Spark plugs—various—\$1,254,188  
Fire control system, T-38 — various —\$439,622  
Auto spare parts—23,153—\$107,832

**GENERAL MOTORS CORP.**, AC Spark Plug Div., Milwaukee, Wis.  
Modification kits for bombing navigational computer—\$58,542

**GENERAL MOTORS CORP.**, Allison Div., Indianapolis, Ind.  
Modification kits for XT-1400 transmission—188 ea.—\$288,532  
Filter oil, transmission main assy.—820 ea.—\$41,082  
Stator, first and second assy.—131 ea.—\$33,097  
Bearings—710—\$41,045

**GENERAL MOTORS CORP.**, Chevrolet Motor Div., Detroit, Mich.  
Trucks—various—\$3,754,532  
Automobiles—5212—\$5,989,973

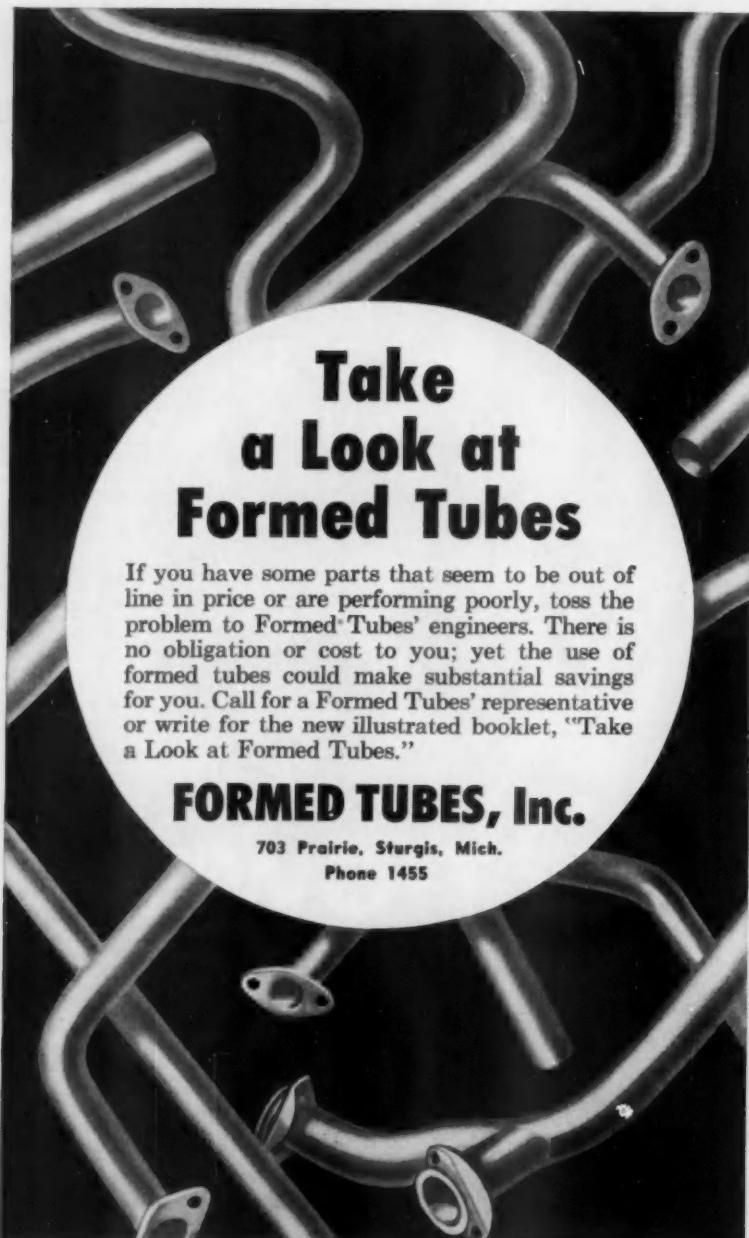
**GENERAL MOTORS CORP.**, Cleveland Diesel Engine Div., Cleveland, Ohio  
Propulsion Diesel engine—20 ea.—\$2,874,839  
Repair parts for Diesel engines—9597—\$35,972

**GENERAL MOTORS CORP.**, Detroit Diesel Engine Div., Detroit, Mich.  
Repair parts for Diesel engines—61,598 ea.—\$158,431

**GENERAL MOTORS CORP.**, Foreign Dist. Div., New York, N.Y.  
Autos—22—\$34,296

**GENERAL MOTORS CORP.**, GMC Truck & Coach Div., Pontiac, Mich.  
Auto spare parts—1476—\$89,839  
Engine spare parts—1792 ea.—\$236,419  
Tire spare parts—254 ea.—\$128,598

(Turn to page 118, please)



PRODUCING PRESSURE VESSELS

# Profitably

CLEARING PRESS RIGHT ANSWER  
FOR TAIT MFG. CO.

Tait Mfg. Co. in Dayton, Ohio found the right answer for production of pressure vessels in the Clearing double crank press shown here. The vessels are produced from .025" stainless steel blanks which are drawn to a depth of 5". High blankholding pressure (70 tons) required at the start of the draw requires that the press develop high tonnage 5" up from bottom stroke. Normally these requirements would call for a press far larger than the one shown at right. However, Clearing engineers designed the press with an oversize drive—a 500-ton drive in a 250-ton frame. Two sets of dies are used in the press, one to trim and draw, the other to pierce and emboss. The press is equipped with two cushions in the bed. Seventy tons of cushion pressure is provided on the draw side for blankholding. This pressure is reduced to 35 tons automatically at a point  $1\frac{1}{2}$ " down on the draw. The other cushion provides 10 tons of stripping pressure.

If you are looking for an efficient and economical method to produce your product more profitably, call on Clearing Machine Corporation to discuss your problem.



Write for colorful brochure,  
"Thinking about a better way to  
do the job?" No obligation.

This Clearing double crank press with an  
oversize drive develops high tonnage five  
inches from bottom stroke, easily solving  
the problem of a 5" draw in stainless steel.

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(Continued from page 116)

**GENERAL MOTORS CORP., New Departure Div., Bristol, Conn.**  
Bearings—11,860 ea.—\$31,574

**GENERAL MOTORS CORP., United Motors Service Div., Detroit, Mich.**  
Automotive spare parts—1852 ea.—\$69,135

**B. F. GOODRICH TIRE & EQUIPMENT CO., Div. of B. F. Goodrich Co., Akron, Ohio**  
Tires, 7.50 x 20—\$471,200  
Tire, 16.00 x 25—77 ea.—\$30,179

**THE B. F. GOODRICH CO., Akron, Ohio**  
Wheel assemblies—various—\$521,645

**THE GOODYEAR TIRE AND RUBBER CO., INC., Los Angeles, Calif.**  
Tires, truck—1433 ea.—\$50,455

**THE GOODYEAR TIRE & RUBBER CO., INC., Akron, Ohio**  
Wheel assys.—1639—\$294,316  
Brake lining—59,184 ea.—\$68,831

**HALL-SCOTT, INC., Berkeley, Calif.**  
Repair parts for gasoline engines—5300  
ea.—\$40,869

**HOLLEY CARBURETOR COMPANY, Detroit, Michigan**  
Automotive spare parts—7260 ea.—\$35,284

**HOLLEY CARBURETOR COMPANY, Van Dyle, Michigan**  
Auto spare parts—1694 ea.—\$41,316

**THE FRANK G. HOUGH CO., Libertyville, Ill.**  
Tractor, gasoline, 12,000 lb drawbar pull—8 ea.—\$69,563

**HUGHES AIRCRAFT CO., Div. of Hughes Tool Co., Culver City, Calif.**  
Kit, control surface tie-in components—\$2,340,000

Fire control systems, fighter, interceptor, fixed, type MG-3 for F-102A type aircraft, controls, automatic flight, interceptor aircraft F-102A—1473—\$31,323,384

Fire control systems, fighter, interceptor, fixed, MG-3 type, for F-102 type aircraft, receiving sets, radio, fire control systems, fighter, interceptor, fixed, type MG-3 for F-102 type aircraft—90—\$3,069,443

Fire control portion, fighter, interceptor, fixed, type MG-3 for TF-102A type aircraft, automotive flight control portion, interceptor aircraft TF-102A, receiving sets, radio—266—\$3,667,472

**HUGHES-KEENAN CORP., Delaware, Ohio**  
Crane, truck, gasoline—30 ea.—\$299,999

**HYSTER CO., Portland, Oregon**  
Truck, fork, Diesel—16 ea.—\$205,828

**INTERNATIONAL HARVESTER CO., Washington, D.C.**  
Trucks—10—\$23,710

Truck, tractor, COE—67 ea.—\$463,296

**INTERNATIONAL HARVESTER EXPORT CO., Chicago, Ill.**  
Crawler tractors and equipment—I lot—\$208,801

**JACOBS AIRCRAFT CO., Pottstown, Pa.**  
Crankshaft assy.—3 items—\$52,607

**KELLETT AIRCRAFT CORP., Camden, New Jersey**  
Gyro stabilizer—job—\$299,241  
(Turn to page 120, please)

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automate...

...thinking. It's true you can punch figures into electronic brains and get fast, accurate answers. But they're only an aid to CREATIVE thinking, which can't be pushbutton operated.

Neither can Pioneer's engineers, but they can design, process and automate production of the finest pushbuttons as well as autos, home appliances, engines, machinery, etc.

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**F**or more than a third of a century Aetna Clutch Release Bearings have held recognized leadership in design, performance and dependability.

**I**n terms of testimony, over 68,000,000 Aetna Clutch Release Bearings have been produced to satisfy the year-after-year demand of more than 50% of America's major producers of on-and-off-the-road mobile vehicles.

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**S**ervice records and laboratory breakdown tests (up to 1,500,000 de-clutchings) repeatedly prove the unmatched superiority of Aetna Clutch Release Bearings—in life-expectancy, lubricant retention and smooth, silent operating characteristics.

**T**ake time—early in the planning stage, before "freezing" your designs—to test and compare world famous Aetna Clutch Release Bearings. Samples, quotations and complete engineering data are yours for the asking.

### Aetna



**AETNA BALL AND ROLLER BEARING COMPANY**

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Manufacturers of: Standard and Special Ball Thrust Bearings • Angular Contact Ball Bearings • Radial Ball Bearing Mounted Units • Special Roller Bearings • Ball Retainers • Hardened and Ground Washers • Sleeves • Bushings • Miscellaneous Parts

(Continued from page 118)

**KELSEY-HAYES WHEEL COMPANY.**  
Detroit, Michigan  
Machinery and equipment for J-57 engine components—\$854,000

**KENTUCKY MANUFACTURING CO.**  
Louisville, Kentucky  
Trailer, semi, van, 12 ton—12 ea.—\$41,812

**LEECE NEVILLE COMPANY, Cleveland, Ohio**  
Regulator, alternator—\$87,745

**LIBBEY-OWENS FORD GLASS CO., Toledo, Ohio**  
Periscope, T36—\$175,824

**LOCKHEED AIRCRAFT CORP., Georgia Div., Marietta, Georgia**  
Services for Phase VI ECM—\$272,394  
Facilities in support of WS-125A program—\$4,000,000

**MOTOR WHEEL CORP., Lansing, Michigan**  
Case cartridge—61,000 ea.—\$270,291

**MCDONNELL AIRCRAFT CORP., St. Louis, Missouri**  
Parts for F2H A/C—various—\$88,279  
Repair of Model 96 store for F-101A aircraft—\$1,509,367

**NORTH AMERICAN AVIATION, INC., Fresno, Calif.**  
Kits for electronic system—\$6,423,555  
Kit, extended leading edges—\$2,656,800

**NORTH AMERICAN AVIATION, INC., Los Angeles, Calif.**

Parts, components, and equipment—45 ea.—\$4,000,000  
Modification of F-100-1 and F-100-2—\$416,118

**THE OLIVER CORPORATION, Chicago, Illinois**

Tractor, wheel, industrial type—34 ea.—\$52,091  
Tractors—2 ea.—\$16,699

**PETTBONE MULLIKEN CORP., Chicago, Illinois**

Tractor, fork, Diesel—64 ea.—\$94,095

**PIASECKI HELICOPTER CORP., Morton, Pa.**

Parts used on HUP-1, 2 and 2S aircraft—various—\$38,551  
Parts used on HUP-1/2/2S spares—various—\$104,086

**PIERCE GOVERNOR CO., INC., Anderson, Indiana**

Modification of fuel controller parts—job—\$466,050

**REO MOTORS, INC., Lansing, Michigan**  
Truck spare parts—907 ea.—\$421,138

**BURTON RODGERS TECHNICAL TRAINING AIDS, INC., Cincinnati, Ohio**  
Cockpit procedure trainer for T-33A aircraft—\$842,713

**SOLAR AIRCRAFT COMPANY, San Diego, Calif.**

Gas turbine compressor—90 ea.—\$3,923,848

**STEWART-WARNER CORP., Chicago, Illinois**

Motor vehicle parts—14,000 ea.—\$39,383

**STEWART-WARNER CORP., South Wind Div., Indianapolis, Ind.**

Ignitor assembly aircraft heater—23 items—\$52,881  
Valve, fuel control assy.—1796 ea.—\$32,130

**STRATOFLEX, INC., Fort Worth, Texas**  
Fitting end—615,000 ea.—\$134,475

**STUDEBAKER-PACKARD CORP., Detroit, Mich.**

Crankcase assemblies—3 ea.—\$55,347  
Repair parts for engines—5203 ea.—\$53,599  
Bearings—2400 ea.—\$96,523  
Repair parts for Diesel engines—9859—\$121,848  
Reduction gears, gear assy.—\$223,000  
Acquisition, installation of machinery and equipment—job—\$1,422,355  
Repair parts—4500 ea.—\$46,440

**SUNDSTRAND MACHINE TOOL CO., Sundstrand Aviation Div., Rockford, Ill.**

Transmission and gear box assemblies—\$1,844,187  
Constant speed drives, transmission—\$6,965,982  
Transmission and governor assemblies—200 ea.—\$647,200

**THOMPSON PRODUCTS, INC., Accessories Div., Cleveland, Ohio**

Fuel booster pump assy.—44 items—\$215,239

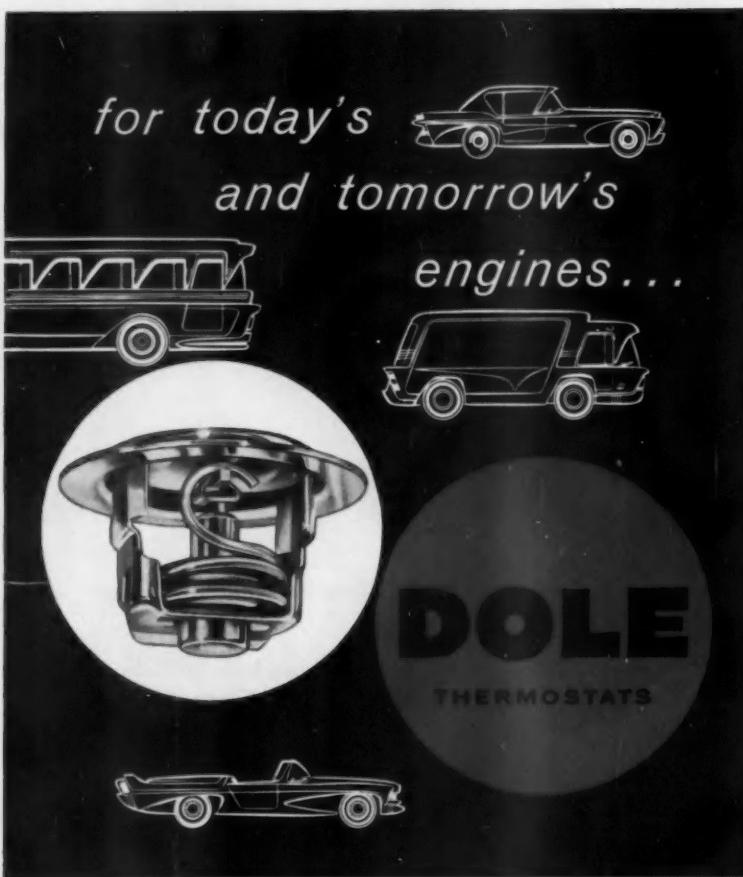
**UNITED AIRCRAFT CORP., Hamilton Standard Div., Windsor Locks, Conn.**

Air turbine starter—865 ea.—\$475,800

**UNITED AIRCRAFT CORP., Pratt & Whitney Div., E. Hartford, Conn.**

Engines—\$33,676,013

(Turn to page 122, please)



these are the reasons why Dole Thermostats are standard equipment on 37 of the leading makes of cars, trucks, tractors, commercial vehicles, industrial and marine engines.

- Positive operation against increased pump pressures
- Good service with all types of antifreeze solutions
- Help maintain best engine performance
- Speed warm-up and get more heat from the car heater.

Write for information.



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YEAR AFTER YEAR... MODEL AFTER MODEL...

**MORE THAN ONE OUT OF THREE CARS ARE EQUIPPED WITH  
MUSKEGON PISTON RINGS**



**MUSKEGON** BECAUSE HAS WHAT IT TAKES

WITH THE BIGGEST FOUNDRY IN THE BUSINESS

What does it take to be the biggest in the business? Facilities, capacity, equipment, ideas, quality control and delivery are all part of the answer. But even more than that, it requires absolute adherence to specifications, proven dependability, and the integrity of the manufacturer to stand behind each and every ring order shipped. These are the reasons why Muskegon is a leader in its field.

Why deal with the biggest in the business? Because complete facilities to deliver any order to your specifications are available—plus advancements and ideas that can only be offered through the experience gained by producing literally billions of rings over the years. It takes the biggest foundry in the business to produce rings for one out of three cars year after year. Isn't it time you counseled with Muskegon for your ring needs?



*No matter what the design of the individual rings needed to fill the grooves of your piston, rely on Muskegon as your source.*

Since 1921...The engine builders source!



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MUSKEGON, MICHIGAN  
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Binks automatic reciprocating spraying machines installed in the Chrysler Division, Kercheval Plant Body Paint Shop, Detroit, Mich.

## automatic spray painting assures quality finish for CHRYSLER'S "FORWARD LOOK"

Lustrous, durable finishes, for which Chrysler cars are famous, are applied automatically by specially designed Binks reciprocating spraying machines. Placed at each painting station are Binks vertical and horizontal automatic reciprocating machines. Model 21 automatic spray guns mounted on curved tracks follow the body contour.

Actuated and controlled by the movement of auto bodies down the line, these machines apply a uniform finish with little material waste. If a body is missing in the line, the spray guns do not operate.

### These benefits can be yours

Binks automatic equipment can be designed to coat or finish almost any mass produced part or product...and do it better, faster and at lower cost.

**Ask about our spray painting school  
Open to all...NO TUITION...covers all phases**



**Binks Manufacturing Company**  
3120-30 Carroll Ave., West, Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES - SEE YOUR CLASSIFIED DIRECTORY

(Continued from page 120)

**UNITED AIRCRAFT CORP.**, Sikorsky Aircraft Div., Bridgeport, Conn.  
Helicopters—\$5,164,092

**UNITED STATES RUBBER CO.**, Los Angeles, Calif.

Tires, truck—1433 ea.—\$50,455

**VICKERS, INC.**, Detroit, Michigan

Motor assys. for various A/C—133 ea.—  
\$48,738

Valve assy., hydraulic pressure—227 items

—\$172,709

**WATSON AUTOMOTIVE EQUIPMENT CO.**, Washington, D.C.

Automobile, ambulance—29 ea.—\$132,398

**THE WEATHERHEAD CO.**, Aviation Div., Antwerp, Ohio

Fitting end—171,000 ea.—\$165,410

**WHITE MOTOR CO.**, Cleveland, Ohio

Truck-tractors—16 ea.—\$98,350

Truck, chassis, with cab—42 ea.—\$280,576

**WILLYS MOTORS, INC.**, Washington, D.C.

Station wagons—10 ea.—\$20,152

**WILLYS MOTORS, INC.**, New York, N.Y.

Trucks—40 ea.—\$84,291

**WILLYS MOTORS, INC.**, Toledo, Ohio

Crankshaft assemblies—\$127,337

Trucks—83—\$135,364

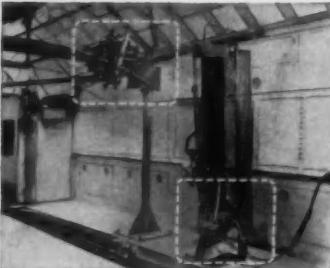
**THE WINTER WEISS COMPANY**, Denver, Colorado

Trailer, mount, M20—600 ea.—\$368,364

**THE YALE AND TOWNE MANUFACTURING CO.**, Philadelphia, Pa.

Truck, forklift, gasoline—29 ea.—\$121,200

## BOOKS ...



Close-up showing the horizontal and one of two vertical reciprocating Binks spray guns at each painting station.

### Free analysis and engineering help

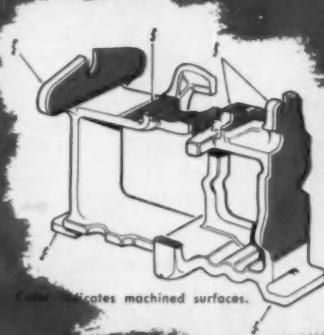
If you would like to know what production rates or costs you could obtain with Binks automatic equipment, Binks research department will run actual tests on your products and supply you with a detailed report. Just call your nearest Binks Branch Office or write us direct.

**RUBBER IN AUTOMOBILE ENGINEERING**, by R. Dean-Averns, published by Natural Rubber Development Board, London, England. Copies available from Natural Rubber Bureau, 1631 K St., N.W., Washington 6, D.C. Price, 75 cents. A survey of the numerous uses of rubber in the automobile with special emphasis on design considerations, this 204-page book covers such important topics as: engine vibrations problems; suspension systems; tires; the clutch, drive, steering, and brakes; rubber in units attached to body and frame; rubber in electrical fittings, hose, seals, etc.; rubber in body building and mounting; rubber in door mounting, glazing, panels, flooring, seating, etc. The text is supplemented by over 100 illustrations and diagrams.

**ELECTRONICS IN INDUSTRY**, by George M. Chute, published by McGraw-Hill Book Co., 330 West 42nd St., New York 36, N.Y. Price, \$7.50. This book is a practical introduction for men in industry to the basic fundamentals of electronic devices and their industrial application. It emphasizes the uses of vapor or gas tubes, and discusses several laboratory electronic instruments, as well as the many non-electronic devices often used in electronic equipment. In this second edition, the latest designs of industrial control are included and a chapter on simple closed-loop systems has been added; this chapter serves as a basic introduction to servos and the principles of automation. Resistance welding is covered more completely than in the previous edition, and the material has been arranged and supplemented so that it may be used for a general or survey course in engineering schools, or as supplementary reading for specialized texts.

# CUSTOMER SPECIFIED

One of the nation's leading manufacturers of communications equipment needed a way to increase production milling of telephone relay frames, reduce unit costs and greatly improve product quality. They called on Kearney & Trecker to solve this problem.



## KEARNEY & TRECKER MILWAUKEE® DESIGNED

Here's Kearney & Trecker's answer: Two 6-Station Rotary Indexing machines which mill 24 surfaces on cast iron telephone relay frames within plus or minus .002" at a combined rate of 360 pieces per hour. Former methods produced only 150 relay frames per hour.

An important cost-saving feature of each machine is the application of standard units — five feed slides and a 48" rotary index table. Such utilization of standard units lowered initial costs, simplified maintenance and increased efficiency.



## High-volume, low-cost production starts with Kearney & Trecker Milwaukee machine tools

Kearney & Trecker automatic production machines accurately perform many operations at lower cost. But most important to you, this is accomplished by combining standard design components — feed slides, way-type drill units, tapping units, quill feed units, rotary index tables — that keep initial machine costs at a minimum. You get the production you want and the econ-

omies you need from job-proven designs. What's more, you get performance to exacting accuracies.

Take advantage of our abilities. See how they can pay off in new profits for you. Whatever your production machine needs, call our representative or write: Special Machinery Division, Kearney & Trecker Corp., 6774 W. National Ave., Milwaukee 14, Wisconsin.

For more information on machine illustrated, ask for Data Sheet No. 1083. A new bulletin, SMD-56, which describes many of our outstanding machine designs, is also yours for the asking.



**Special Machinery Division**

MILWAUKEE 14, WISCONSIN, U.S.A.

**Designers and Builders of Precision and Production Machine Tools Since 1898**

## Facts About Sealed Power Cyclan Ring Iron

(Continued from page 52)

ing pistons with an additional 0.020 in. clearance over normal between the ring and ring groove. The engine was operated at 4000 rpm, wide open throttle and checked periodically for top ring condition. After several test runs, it was found that the standard iron rings would break within two hours, whereas the Cyclan rings functioned as long as 8.5 hours with not

one breaking at less than five hours.

Another series of tests was conducted in a six cylinder in-line truck engine. This engine was equipped with pistons having the bottom of the top groove tapered at a three degree angle in order to twist the rings on each compression and power stroke. A split setup of standard cast iron and Cyclan was installed and tested

at 3200 rpm, full load. The duration of the test was 107 hours with no breakage occurring in the Cyclan rings for the entire test. The maximum running time on the standard iron rings before breakage was 75 hours with one ring breaking at 20 hours and two at 11 hours. These accelerated ring breakage tests typify the added life of Cyclan over standard iron in service.

An unusual approach to the higher strength piston ring material is evidenced in the development of Cyclan. Here is a combination of the high phosphorus properties of the time proven standard ring iron, the numerous well distributed carbides characteristic of the well known Rolls-Royce ring iron, and the star-like temper carbon present in many higher strength materials. Cyclan not only represents a combination of these three metallurgical factors but also fulfills the requirements for piston rings in high output engines. The wear resistance, strength, modulus and impact strength are definitely increased over standard iron while the loss of properties after exposure to high temperature is markedly less.

The following chart gives the typical chemical make-up of this iron:

Total Carbon .....	2.85-3.10
Silicon .....	1.75-2.10
Sulphur .....	.10 max.
Phosphorus .....	.25-.45
Manganese .....	.60-.90
Chromium .....	.50-.85
Molybdenum .....	.30-.50
Vanadium .....	.08-.15
Nickel .....	Residual
Hardness .....	100-108 R <sub>s</sub>

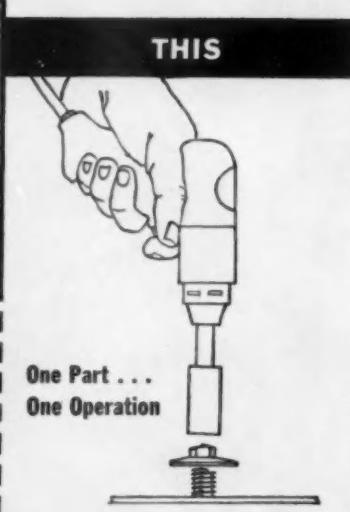
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of  
Mouldings, Nameplates,  
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**REAL SAVINGS** when Washer Type PALNUTS are applied to your mouldings, nameplates, medallions, deck handles, tail and parking lights, instrument mountings, etc. Also real security, due to live spring locking action. Popular thread sizes always in stock. State thread size and washer diameter or clearance around stud or bolt when requesting free samples.

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**WASHER TYPE  
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TRADE MARK®  
**LOCK NUTS**



### INSTEAD OF THIS

3 Parts . . . 3 Operations

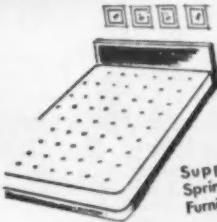


### BOOKS . . .

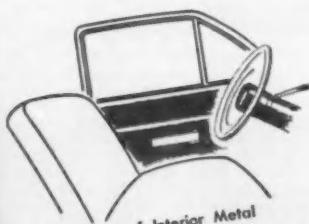
CUSTOM HOUSE GUIDE, published by Custom House Guide, Box 7, Station P, Custom House, New York 4, N. Y. Price, \$25.00. The 1956 edition of this 1688-page encyclopedia of foreign trade contains the latest United States Customs rate of duty for each of the 20,000 commodities listed in the alphabetical index, as well as U. S. Customs Regulations, Administrative Provisions of the Tariff Act, and the Internal Revenue code, with all official revisions and additions. Also included is the revised listing of U. S. Customs ports of entry and their corresponding ports in Canada and Mexico. The various ports, arranged alphabetically, are treated in considerable detail. Among other information, the volume lists port charges, geographical limits, forms of transportation, customs personnel, consular offices, and airline freight offices for each port. Altogether, a valuable reference book that belongs in the office of anyone doing business through the various ports of the United States and its territories, as well as of Canada and the Philippines.

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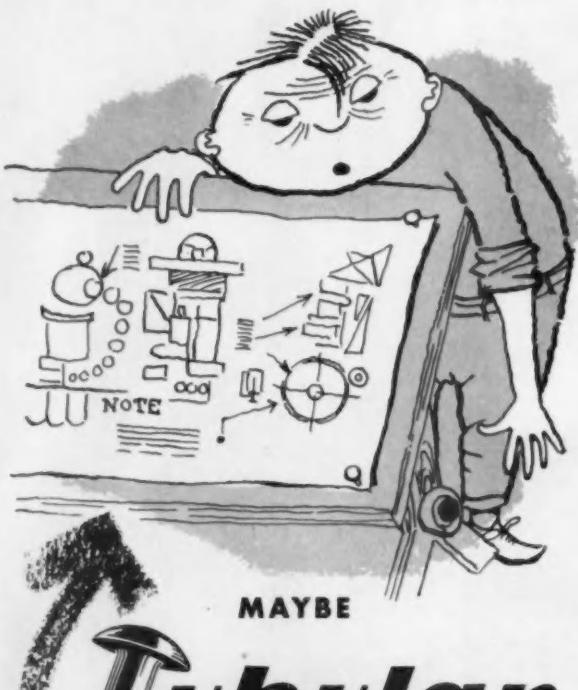


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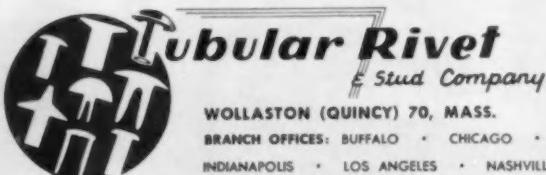
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standard or special rivets in metals from steel to silver, in numerous types, sizes and finishes; with single or automatic Multi-Head machines to set them.

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## Bradshaw Free-Piston Gas Generator

(Continued from page 102)

risk of stalling on a misfire. The crankshaft also drives the fuel and lubricating oil pumps, but no external power is taken from it.

The compressor is of similar construction to the Diesel, but about five times its cubic capacity. It has two sets of pistons driven from the crankshaft through two further coaxial shafts. Here the fixed annular cylinder has eight air inlet ports on one side, and four outlet or transfer ports on the side abutting on the engine.

Each opposed pair of compressor piston faces exposes two large inlet ports at the outer limits of their swings. These are sealed by the pistons as they move in together on compression, but the transfer port is a function of the corresponding Diesel piston in the other cylinder. The cycles of the two units are phased so that this communicating port is opened at the point of maximum air pressure between the compressor pistons, which coincides with an exhaust stroke in the engine. Thus optimum supercharging is obtained.

The engine is cooled by water jackets cast into the iron cylinder, as well as by the large volume of air employed. Shaft bearings, cylinder walls and reciprocating disks and seals are pressure-lubricated through galleries in the castings. Further development work on this gas generator for automotive applications is being conducted by Mr. Bradshaw at Westerton, near Chichester, England.

## BOOKS ...

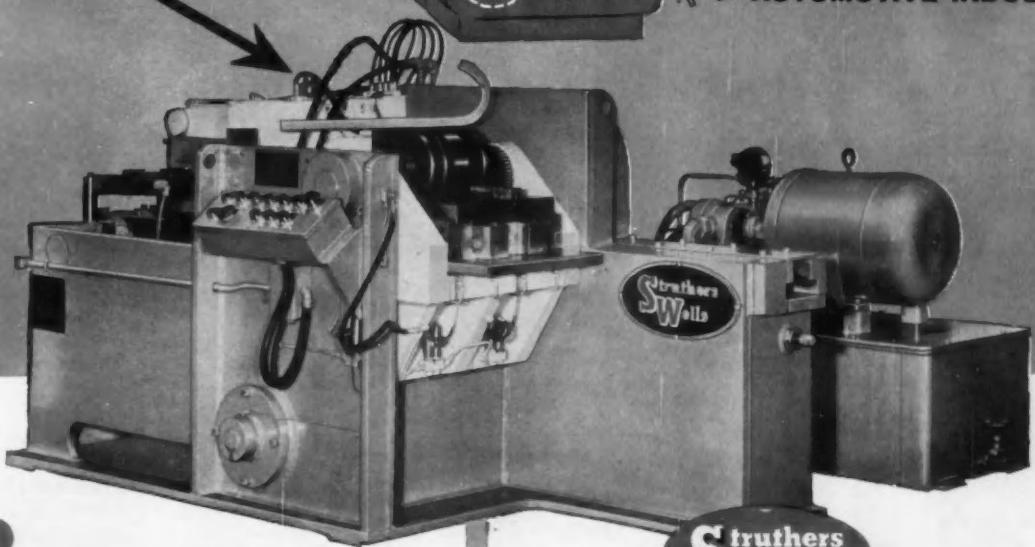
HIGH TEMPERATURE TECHNOLOGY, edited by I. E. Campbell, published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price \$15.00. This book offers in succinct form the highlights of recent research in the development of new materials of construction for service at very high temperatures. The monograph is divided into four sections: an introductory section, which traces the development of modern refractories and modern high temperature techniques; a materials section; a methods section; and a measurement section. Although consideration is given primarily to service at temperatures above 1500°C, much of the discussion relates to processing materials at moderate temperatures for service at the higher temperatures. Thirty-five outstanding workers in the field have contributed to this comprehensive treatment of new materials, production methods, and techniques for measuring properties.

# SEAT POSTS

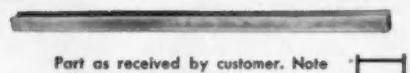


ONE OF THE MANY

STRUTHERS WELLS  
TANGENT BENDER  
PRODUCTS NOW  
IN USE BY THE  
AUTOMOTIVE INDUSTRY



1



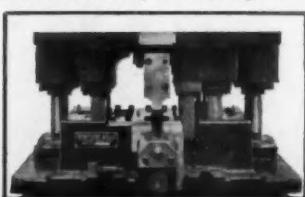
Part as received by customer. Note  
roll-formed box section.

Struthers  
SWells

2



One end flattened, in die set-up shown.



3

The formed seat post. Tangent Bender  
has upset metal free of wrinkles through  
180° radius bend.

## TANGENT BENDERS

Smooth, fast, one-operation bending of many parts in use by the automotive industry is now provided at high production rates by the Struthers Wells Tangent Bender. Automatic load and unload is afforded, and complete SW automated sequences developed, including sheet destacking, punching and notching, roll forming, bending, and welding. Let us consult on your requirements.

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Bending Machines . . . Press Brakes . . . Punch-  
ing and Notching Machines . . . Forming Dies

## SPI 7th National Plastics Exposition

(Continued from page 49)

Phenolic resin impregnated paper is being molded into door foundation panels and arm rest housings. Advantages realized are dimensional stability and lower fabrication cost when complicated draws are required.

It is difficult to predict where phenolics may next be used in large volumes, but it is safe to state that chrome plating of phenolic parts is likely at some time to replace many

of the plated zinc die cast parts used today.

The remaining thermosetting materials are not widely used in automotive applications. The alkyds, because of their excellent electrical properties are being used for spark plug insulators on Chrysler V-8 engines and by one automotive company for coil towers. They have received considerable attention for

distributor caps, rotors, and coil towers by all companies. Their existence has forced the phenolic suppliers to improve their products in order to hold the business. If the volume price of the alkyds were competitive with phenolics they would certainly replace them for the above mentioned parts. Some urea compounds have been used for knobs. For example, if a part were originally released as a phenolic and then it was decided to go to light colors, ureas are a practical replacement because no tooling change is required.

To overcome vinyl's breathing limitation, considerable effort is being made to produce a breathable vinyl fabric. The most practical creation to date was introduced by one of the rubber companies and utilizes a discontinuously coated fabric in which the vinyl is deposited as "islands" on a vat dyed, 1.06 broken twill cotton fabric. Such a construction permits utilization of attractive designs and ample fabric area for breathing. Use of vat dyes insures a material that can be cleaned satisfactorily.

Cellulose propionate is currently being evaluated as an optional material for the butyrate. Chrysler, for example, is now satisfied that it can be used for arm rest bases and will release it as optional.

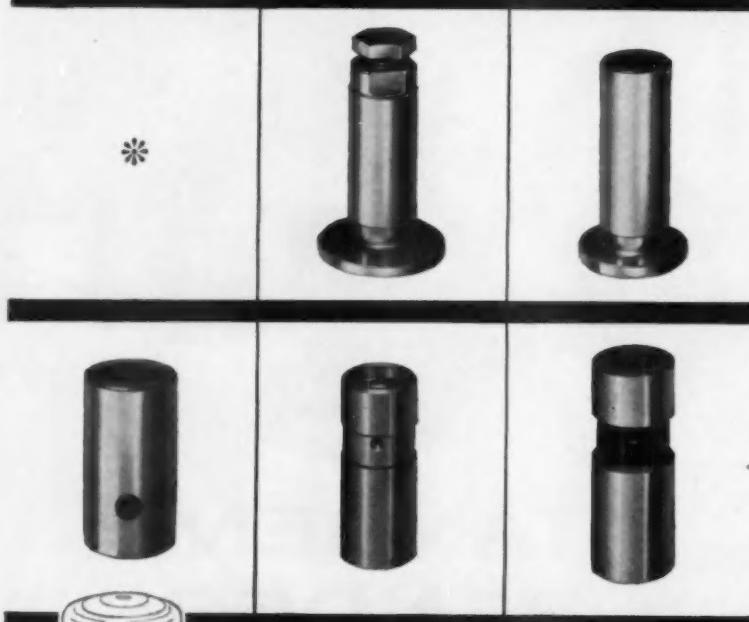
In the future, an increasingly important usage of polyethylene will be molded fasteners and plugs. Currently we use barbed shank, self attaching polyethylene fasteners to install the dash liners and they are performing very satisfactorily. Cost and good sealing characteristics are their main advantages. The plugs are primarily used to protect functional parts such as hydraulic steering pumps and adapters during shipping and to fill holes in the dash panel or other locations on the body. There is every reason to believe that with new designs these applications will expand.

A comparatively new usage of saran, which was developed at Chrysler, is a gas fuel filter made from woven saran cloth. The filter construction is two pieces of cloth bonded together with dielectric heating around the edges and at several locations in the center of the disk. The weave of the cloth and the yarn size are important factors, and the fabric must be calendered with a pressure necessary to produce a specified porosity.

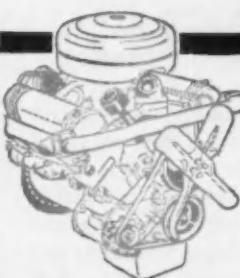
Rigid plastic sheet materials which can be vacuum formed are now important trim items. In general they are mixtures of copolymers, one of which is known as "Royalite." Al-

(Turn to page 131, please)

## JOHNSON *tappets*



\*  
*keep pace with today's engines*

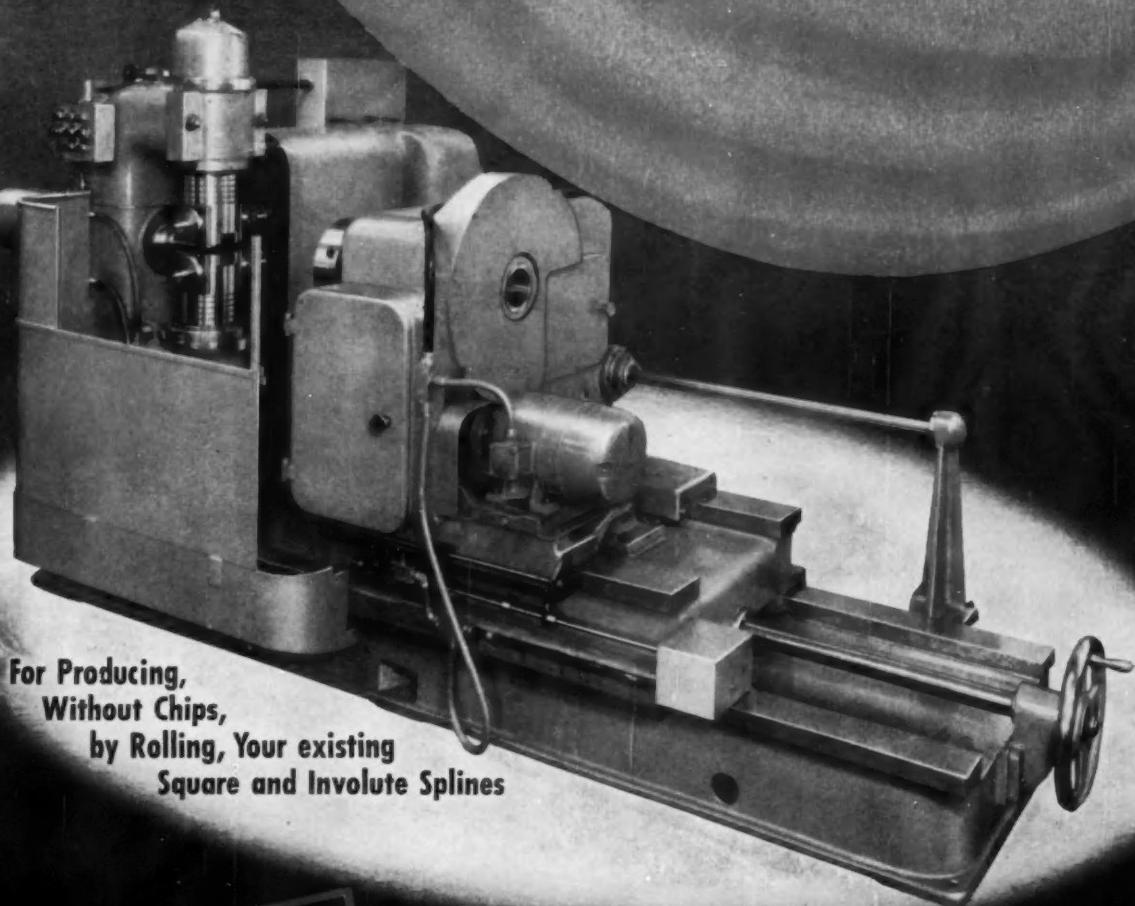


Continual experimentation and excellent manufacturing methods show a steady product improvement that make JOHNSON TAPPETS worthy of your consideration. Only proven materials, covering a range of steel, chilled iron, and various iron alloys are used in the manufacture of JOHNSON TAPPETS, providing greater strength, light weight and increased wear resistance. Serving the AUTOMOTIVE — AIRCRAFT — FARM — INDUSTRIAL — MARINE Industries.

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**LEES-BRADNER** Manufactured,  
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REVOLUTIONARY

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### S P E C I F I C A T I O N S

#### Capacities

Root Diameter of work Max. 4" Min.  $\frac{3}{4}$ "

Between centers Max. 48"

Length of Spline Max. 9"

Diameter of hole through work holding spindle 6"

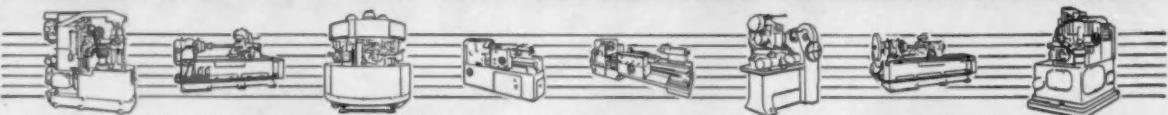
Work Spindle Speeds—1800 RPM divided by the number of teeth in the work

Motors—Main Motor 10 HP. Rapid Traverse Motor 5 HP. Rev. Feed Motor 5 HP. Pump Motor  $\frac{1}{2}$  HP.

Length 14 ft. Width 6'6" Height 6'0"

Weight (net) 15,000 lbs.

*the* **LEES-BRADNER** *Company*  
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IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

## SPI Plastics Exposition

(Continued from page 128)

though the material costs are relatively high, fabrication techniques have been worked out which have made part prices practical. Then too, the installation costs are low compared with fabric materials so that the final installed price is favorable.

The most recent plastic to stimulate the imagination of interior automotive designs is Mylar. Metalized films of this material laminated to vinyl film or fabric became the first practical flexible bright metal-like film available for such applications as seating welts, kick pads and door panel inserts. As might be expected, it was utilized as quickly as adequate bond strength could be obtained between the metalized film and the backing material. To date, most applications involve the use of embossed designs. This is necessary to minimize slight imperfections which result in the fabrication and handling of the parts.

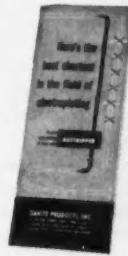
## Advances in Body Manufacturing Techniques

By John G. Coffin  
Chevrolet Div., GMC

THE most significant departures from past practices in reinforced body manufacture have developed in the assembly plant bonding operations. Until recently the method of attaching and joining major components consisted of riveting through external coach joint flanges after an asbestos reinforced polyester bonding material had been applied to one or both pre-scuffed flanges. The primary purpose of the rivets was to secure the joint during curing of the bonding material. This permitted handling of the parts without waiting for the adhesive to cure and the sequence of operations could proceed without interruption. Some contribution to the strength of the attachment was originally considered to be a secondary function of the rivets but exhaustive tests proved that the adhesive provides substantially all of the joint strength. A complete redesign of the major parts described in the foregoing for the 1956 model necessitated extensive revision of this bonding procedure. The external coach joint was eliminated and while a joint between upper and lower outer panels extending entirely around the body shell was continued, it was styled to be patched so as to

### HAVE YOU TRIED THIS EXTRAORDINARY CLEANER?

Oakite Rustrripper removes rust and heat scale in the same operation that removes oil. It avoids hydrogen embrittlement, damage to machined surfaces and other disadvantages of acid pickling.



### Have you taken the four good steps?

How can cleaning costs be reduced 33% while cleaning quality is being improved?  
*See pages 7 and 8 of booklet.*

What are four easy ways to improve the average rinse tank? *See page 10.*

What causes hydrogen embrittlement during electrocleaning? What is the remedy?  
*See pages 15 and 16.*



### Do you need a brass cleaner that gives better protection against tarnishing?

Oakite has a new brass cleaner that provides scientific protection against the oxygen that tarnishes brass and other copper alloys during the application of reverse current.



### "It cut our cleaning rejects by more than 90%"

says a manufacturer who found that Oakite Composition No. 95 gave him:

**BRIGHTER PLATING**—All films removed... no residues, no undersurface shadows, no anodic blackening, nothing to impair the brightness of the electroplate.

**FEWER REJECTS**—Major causes of blistering and peeling eliminated... Consistent success in baking for 60 minutes at 300°F.



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be invisible. Of further importance in regard to this joint is that it must remain invisible after lengthy time and mileage in service. These aspects coupled with some early troubles with bonded joints stimulated a search for the strongest joint design obtainable which would be practical from a manufacturing standpoint. Each design has its particular merits and disadvantages relative to cost, a strength and ease of assembly. The strongest joint based on static and fatigue laboratory tests (consistent with production feasibility) was found to be the channel reinforced

butt joint. This is the design used for joining the front upper assembly to the underbody and rocker panels. Assembly and bonding of the front end are accomplished in bonding bucks—upside down. Since no rivets are used, joints are secured with clamping blocks and pads until the resin bond hardens sufficiently to permit handling. Any gaps in the joints on appearance surfaces are patched before painting and cannot be detected on very close examination after the finish is applied.

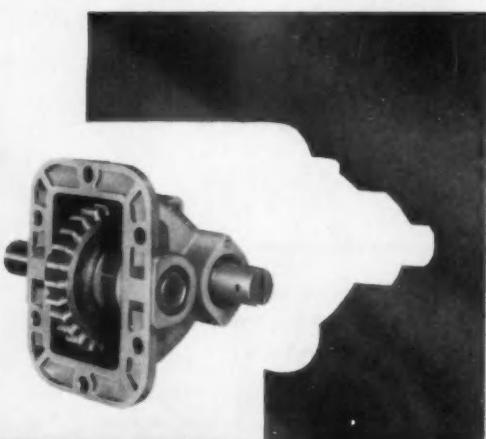
The significance of this development lies in the complete reliance on

bonding and patching to obscure this joint. The method has been completely successful and since its fatigue durability was established, before production was undertaken, it is certain that service deficiencies will not be encountered.

The other important and comparatively new development in reinforced plastic for bodies arose in connection with the use of hang-on fender panels for the Cameo  $\frac{1}{2}$ -ton pick-up truck. The hang-on fenders lend appearance qualities not generally obtainable or formerly associated with the truck field. The transformation is accomplished with relatively few plastic pieces and a standard  $\frac{1}{2}$ -ton cab and pickup box. These trucks are built at 10 different assembly plant locations because the basic cab is standard. This means that, in the interests of plant space conservation, the plastic parts must be capable of being processed through regular truck production facilities. The primer and enamel ovens operate at 275 F and 250 F respectively. The total cycle is somewhat variable and takes about 75 min.

In order to secure reinforced plastic parts which would fulfill these requirements, without warpage or deterioration, it was necessary to modify the laminate materials. Improved rigidity at temperature, impact properties (which still are adequate), and resins resistant to heat crazing must be used. These measures have ensured entirely satisfactory operations on this model.

While the selection of reinforced plastic for automotive panels is confined to special cases where the economic factors favor its choice, it has definitely become a material to be considered in low volume situations.



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THE NEW TULSA<sup>®</sup> SINGLE SPEED, MEDIUM  
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## BOOKS...

THE MECHANICAL PROPERTIES OF WROUGHT PHOSPHOR BRONZE ALLOYS, by G. R. Gohn, J. P. Guerard, and H. S. Freyman, published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, \$3.00. This publication shows the effect of cold working on the mechanical properties of a series of eight phosphor bronze alloys in two conditions, in the form of cold-rolled strip with tin content varying from 0.5 to 16 per cent. Electrolytic tough pitch copper strip, similarly treated, is included to provide a base for evaluating the effectiveness of tin additions. The mechanical properties are reported for six different tempers of each of these materials. These properties include tensile strength, proportional limit, yield strength at both 0.01 to 0.2 per cent offset, modulus of elasticity, elongation, bending fatigue characteristics, and the Rockwell Hardness (B and 30 T values).



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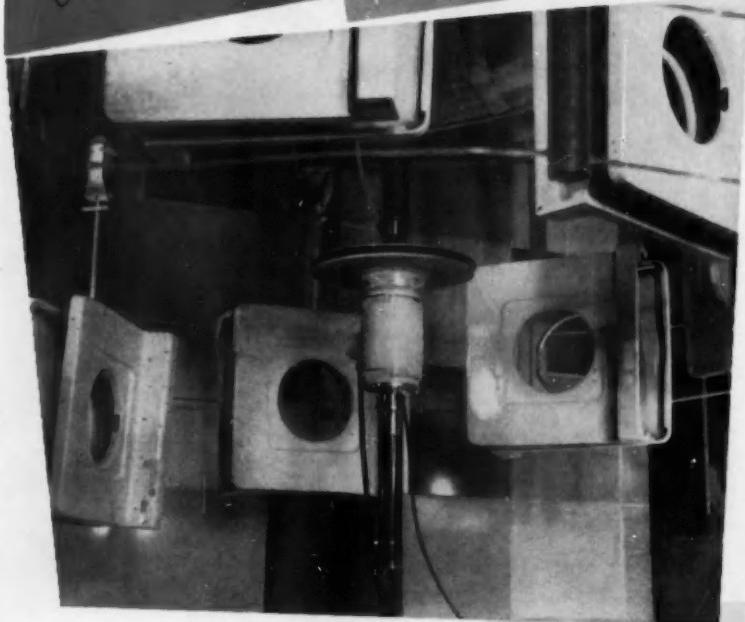
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Yes, even spectacularly—

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General Electric—an extensive user of Ransburg Electro-Spray for painting with synthetic enamels—is the first to use Ransburg No. 2 Process in the application of porcelain enamel.

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Quality of appearance and chip resistance are greatly improved with all colors: white, yellow, pink, turquoise, blue and brown.

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Because of improved uniformity in coating thickness, weight of applied enamel was substantially reduced.

Because of lower application weight, the few rejected parts can be re-processed more times before being scrapped. This reduces the ultimate scrap rate by at least 95% of that previously expected.

Efficiency, measured by the amount of good ware, averages above 90%.

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Mid-year Commerce Dept. industrial survey indicates continued high output and sales in most major industries. Reports on the automotive and aircraft industries are summarized as follows:

**AUTOMOBILES, TRUCKS, AND TRUCK-TRAILERS:** Production of cars in the last six months of 1956 is expected to reach 2.815 million with the major portion being produced in the fourth quarter. Added to the first six months' output, this production would bring a six-million-unit year, fourth best in the industry's history. Truck production will continue strong in the last six months of this year, with total output estimated at 1.150 million units. Truck-trailer production continues at a high level with production total for 1956 estimated at 75,000 units.

**ACCESSORIES AND AUTOMOTIVE REPLACEMENT PARTS:** Dollar volume sales continue strong. Factory sales for 1956 are expected to exceed comparable 1955 sales, which went over \$2.5 billion for an all-time high.

**AIRCRAFT:** The backlog of aircraft orders on hand, but undelivered, is in the order of \$15 billion, as compared with a backlog of \$13.5 billion last January. The current backlog is about 20 per cent civilian in character.

Metalworking firms soon will be able to get a first-hand look at the exact provisions of Government orders that will apply in time of war or emergency.

Federal Trade Commission reports that corporate mergers hit a five-year peak of 846 in 1955. It states that 689 mergers—more than four-fifths of the total—were carried out by manufacturing and mining industries.

Strict new rules governing distribution of nickel, nickel alloys, and nickel scrap are now in effect. Copies of the new regulations, (Direction 6 to DMS Reg. 1; BDSA order M-1B, and Direction 7 to BDSA Reg. 2) are available from all Dept. of Commerce field offices.

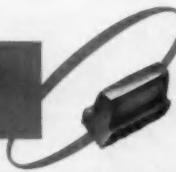
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This electronic sound discriminator is readily adjusted to reject gears at any point within the range of audible noise frequency and intensity.

The Model GSR Speeder for gears and pinions in the smaller sizes is fully automatic. Gears are loaded, run in both directions, with and without a brake load and are either passed or rejected by the electronic sound discriminator as a continuous operation. **Write for Details.**

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ORIGINATORS OF ROTARY SHAVING  
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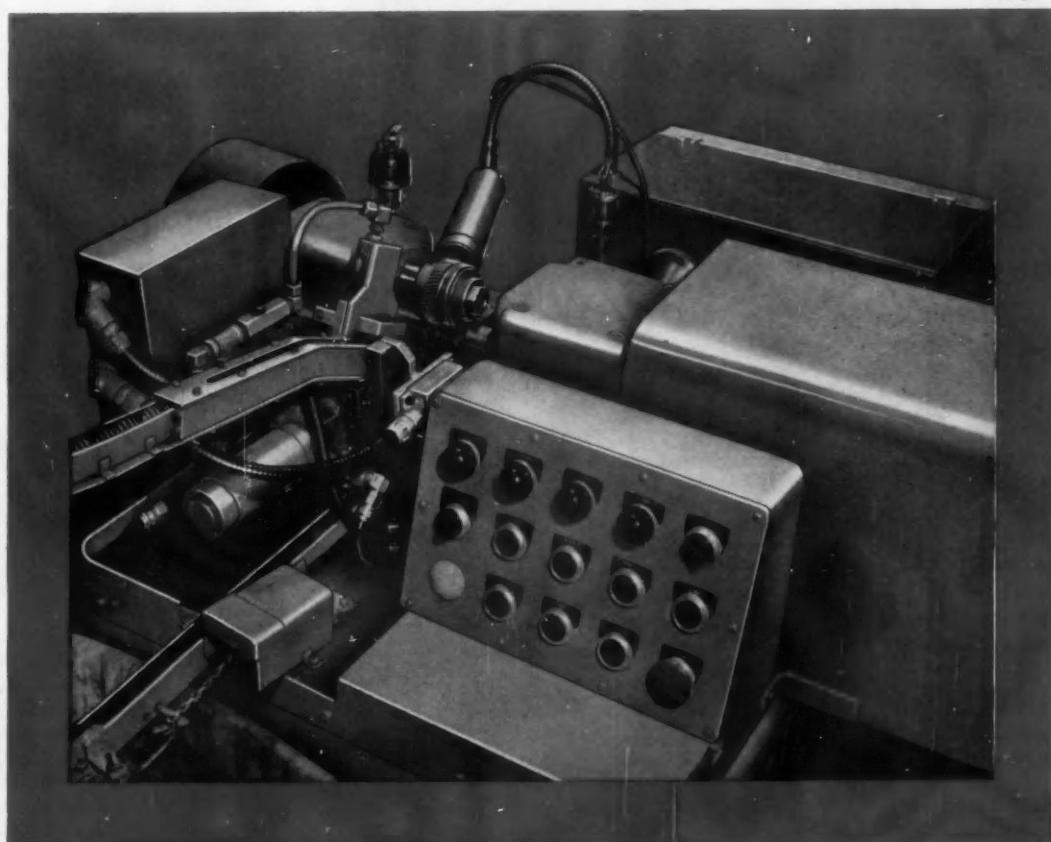


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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

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## Airframe Control Gearing Requirements

(Continued from page 73)

Standard 236.03, which defines gear accuracy in terms of total composite error. For example, there are conditions which will permit a gear to conform to the total composite error limits for a particular class but still have linear errors in excess of what should be expected from that class of gear. This is sometimes due to shaving a gear, which removes eccentricity but not the positive error.

In view of this, it is apparent that an accuracy tolerance must be specified for the completed assembly and not for only the individual gears, shafts, etc.

Precision gearing is not always a problem of instrument type gear trains alone. Often power gear trains are required to have the same order of accuracy, as well as having low reflected inertia. Consideration of the

inertia effects will sometimes cause problems associated with tooth strength and overall gearing accuracy due to scale effects.

From the standpoint of accuracy, it is advantageous to have the gears as large as possible to minimize rotational errors. From the standpoint of inertia, it is desirable to have the gears as small as possible to reduce inertia at the motor shaft. Power-gear trains of this type are used to drive and position radar antennas of all kinds, from light weight airborne equipment to heavy, ground-based antennas. In all cases, the drive is servo controlled and the loads and inertias have to be matched with the motor and amplifier characteristics. This is necessary to obtain the accelerations and stability required for the system.

Gear accuracy is still a prime consideration in such power drives, although the data feedback is provided by means of precision instrument gears. High motor speeds often cause pitch line velocities from 1000-2000 fpm at the high speed end of the drive, necessitating precision Class 1, 2 or 3 gears. Backlash requirements of one minute maximum at the low speed or output end of the drive also requires precision Class 1, 2 or 3, depending on size of the gears and whether the last mesh is adjustable.

To summarize, it can be said that as the requirement for increased accuracy becomes more pressing, the quality of the gears will have to be extended. This will require not only additional classes of precision gears, but a closure of some loop-holes in present AGMA standards. Standardization of accuracy terminology and specifications for both individual gears and gearing assemblies would do much to help this situation.

### GEAR MOUNTING

Instrument gear trains that require accuracy cannot use gears which are attached to shafts by means of set screws, clamping hubs, or collets. There is too much possibility of the gear being shifted off center, creating errors perhaps greater than those inherent in the gears. Critical gears must be a light press fit and pinned to the shafts.

Precision gear trains transmitting appreciable torques should have gears and shafts of one piece construction. Often the gear blanks are brazed to the shaft to eliminate excessive machining. When it is not possible to do this, it is an acceptable procedure to pin the gear to the shaft at assembly.

(Turn to page 138, please)

# ROCKFORD

*This is the Clutch that the nations largest manufacturers of heavy-duty machines are showing as a NEW feature*



\*TRADE MARK



"MORLIFE clutch has gone 851 hours without slipping or adjustment."



"MORLIFE clutch going strong after 1695 hours, working in sand."



"MORLIFE clutches last 950 hours longer, without adjustment."



"MORLIFE clutch needs adjustment once a month, instead of daily."



"MORLIFE requires lighter handle pull and one tenth the adjustments."



"MORLIFE pulls harder and lasts six to ten times longer."



"Won't buy a unit that isn't equipped with Durable MOR-LIFE clutch."

## New MORLIFE\* CLUTCHES and CLUTCH PLATES Give—

MORE Clutch Life (400% MORE)

MORE Torque Capacity (100% MORE)

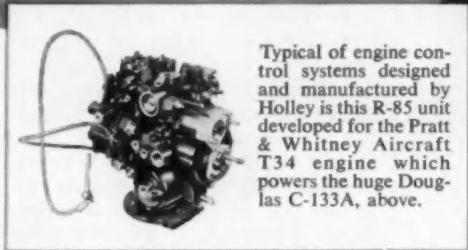
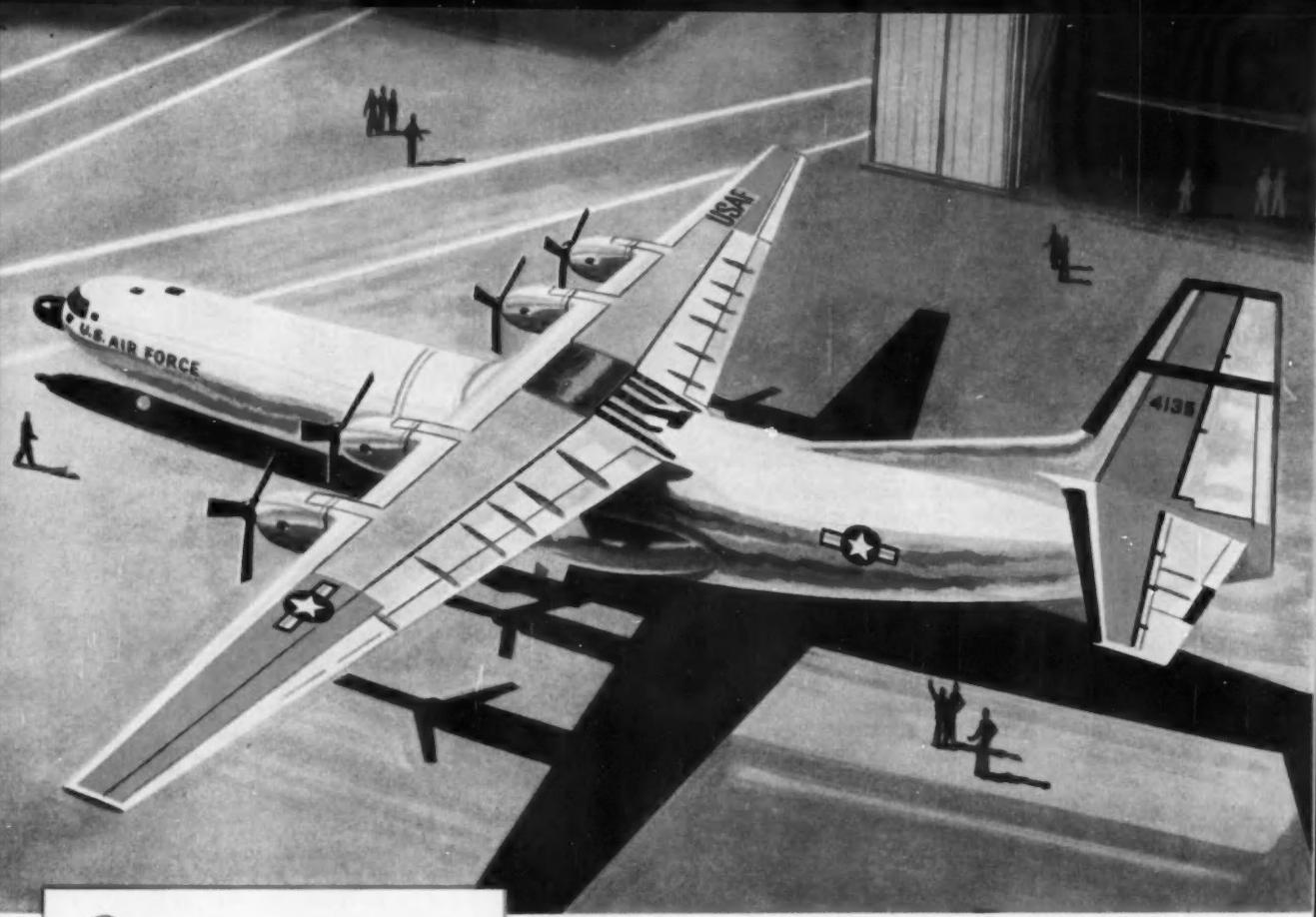
MORE Heat Resistance (50% MORE)

These new ROCKFORD Clutches and Clutch Plates have been developed by ROCKFORD Clutch Engineers to take full advantage of recently discovered facing material. Actual field tests on heavy duty equipment have resulted in adoption of MORLIFE clutches by builders of tractors, earth movers, graders, shovels, cranes, trucks, oil field equipment and power units. For information how these new Rockford MOR-LIFE Clutches will improve the operation and increase on-the-job hours of heavy duty machines, write Department E.

**ROCKFORD Clutch Division BORG-WARNER**

315 Catherine Street, Rockford, Illinois, U.S.A.

# CLUTCHES

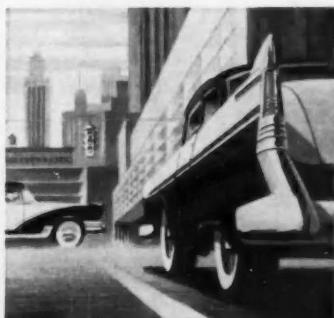


Typical of engine control systems designed and manufactured by Holley is this R-85 unit developed for the Pratt & Whitney Aircraft T34 engine which powers the huge Douglas C-133A, above.



More than half of America's truck manufacturers use Holley integrally-designed engine control systems to provide their products with maximum power at minimum operating cost.

More than ten million automobiles on the road today are equipped with carburetors, distributors and heat regulators designed by Holley to give finest engine performance.



## Giant new cargo carrier uses Holley engine control system

Imagine the power required to lift this plane and cargo of 137½ tons into the air. Largest transport ever produced, the huge Douglas C-133A is equipped with four Pratt & Whitney T34 turboprop engines together with Holley R-85 fuel controls.

In cooperation with engine manufacturers, Holley engineers design, develop and manufacture many aircraft engine controls vital to the air defense of the U.S. Among them: components for the J-57 engine which powers many of the new "century" series interceptors.

Additionally, Holley has built carburetors, distributors and heat regulators for more than ten million automobiles on the road today. And more than half of America's major truck manufacturers factory-equip their products with Holley engine control systems.

Wherever engine control systems are needed, Holley's half century of design, engineering and manufacturing experience can best meet your requirements.

*For more than half-a-century — original equipment manufacturers for the automotive and aviation industries.*

**HOLLEY**  
*carburetor Co.*

# OLSEN

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**Elec~~dyne~~**

Static-Dynamic Balancing Machines

- **Instantaneous Unbalance Indication** The exclusive Olsen Elec~~dyne~~ takes the guesswork out of balancing . . . instantly indicates the amount and angle of unbalance on two large meters. Even minute quantities of unbalance are quickly pinpointed by this highly sensitive electronic indicating system.
- **Ease of Operation** Operator merely inserts the part and starts the machine. In a matter of seconds he knows the angle and amount of indication for both planes of correction.
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- **Simplicity of Calibration** Both the Angle and Amount Meters can be calibrated quickly with the aid of a screw driver. Expensive "masters," and trial and error methods to obtain a "zero" unbalance are eliminated.
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Bulletin 49 contains details on the complete line of Olsen Elec~~dyne~~ Balancing Machines. Write for your copy.

**TINIUS OLSEN**

Testing & Balancing Machines

**TINIUS OLSEN**  
TESTING MACHINE CO.

2090 Easton Road • Willow Grove, Pa.

## Gearing Requirements

(Continued from page 136)

The use of standard keys and key slots in a reversing drive will give the effect of increased backlash as a result of the clearances between key and key slot. This is particularly critical at the final or output mesh. Should it be absolutely necessary to use a key at this location, then it is required that the key be specially fitted to both the shaft and hub. The key then has two thickness dimensions and should be marked to prevent improper assembly.

Although the use of splines is common in many fields of high grade gearing, splines are not generally recommended for the output gear of an extremely precise drive because of possible difficulties with fits and concentricities.

Another point of consideration at the final output gear is the amount of possible tooth and shaft deflections that could increase the apparent backlash. Shaft deflection can be torsional and/or bending due to the separating forces from the gear mesh.

It is true that the errors resulting from these sources are small, but when the overall allowable pointing error of a radar antenna is held to something less than five minutes of arc such careful planning and designing are necessary. Particularly when it is considered that there are five sources of errors contributing to the overall limit of five minutes. Namely: Initial alignment of antenna components, errors of rotation due to eccentricities, errors in data transmission gears, resolver errors, and backlash in drive gears.

### Summary

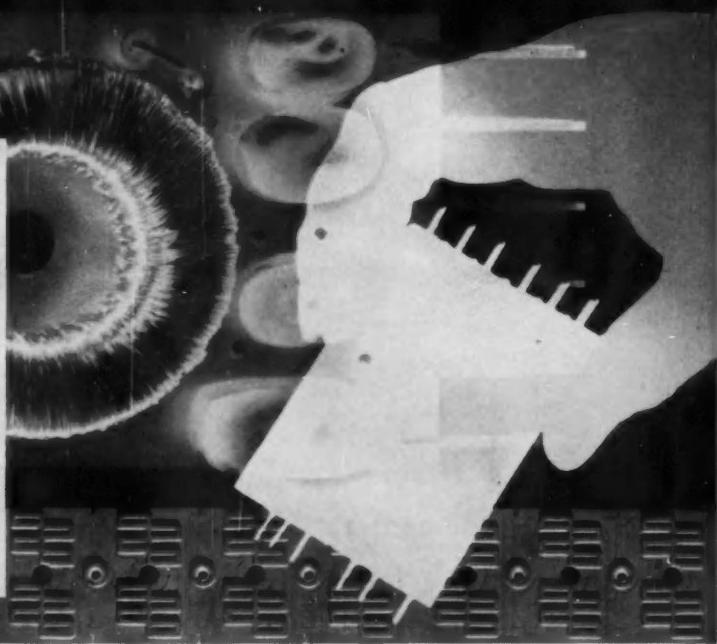
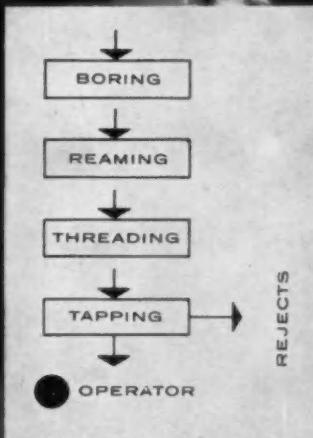
There is a growing need for a greater degree of accuracy in gears than is currently available. Using the same rate of accuracy progression that exists for the present precision gears, it is indicated that classes 4 or 5 and possibly 6 should be created; along with a general revision in the present AGMA standards for fine pitch gearing.

In the past, errors in electronic components exceeded mechanical errors. Today errors in both areas are fairly well balanced. Tomorrow, when potentiometer linearity improves from 0.01 per cent to 0.002 per cent the gears will have to be five times better than they are now.

The gears will have to operate with

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## AT WORK...



### *More reliable, automatic control for machine tools*

Fast reaction without a moving part . . . a control that maintenance men can walk by without ever touching—these are some of the benefits you get from CYPAK\* control systems on machine tools. By eliminating the causes of relay failure—wear, jamming, corrosion—CYPAK gives you greater control dependability and none of the usual control maintenance costs. And CYPAK's greater speed in handling signals often permits a wider range of work on machine tools than from those equipped with conventional controls.

CYPAK's elements are encased in solid, plastic blocks which are plugged-in—locked-in to a common power channel. Slip-on connecting wires join the signal terminals. This modern control design permits addition or a recombination of control functions at minimum time and cost and gives you greater adaptability if change-over is necessary.

This is how CYPAK control systems back up machine-tool production. Your Westinghouse representative has more information on steel, paper, rubber, and other industrial applications. Call him today. Or write Westinghouse Electric Corporation, Department B, P.O. Box 868, Pittsburgh 30, Pennsylvania.

\*Trade-Mark  
J-21963



### ***WATCH WESTINGHOUSE!***

***WHERE BIG THINGS ARE HAPPENING TODAY!***

very little friction, have form durability, be unaffected by heat, cold and high vibrations, and require no lubrication. New materials are clearly indicated.

The foregoing is an abstract of a paper presented by the author at the 40th Annual Meeting of the American Gear Manufacturers Association held at Hot Springs, Va., last June.

## THE CYCLE RACE

(Continued from page 59)

the future passenger car? In the foreseeable future, the petroleum industry will have gasoline of high enough octane rating at the fuel

pumps to allow the use of compression ratios as high as 12 to 1 or 13 to 1. This is not at all fantastic, but can be anticipated from the rate of in-

crease that has taken place since C. F. Kettering accelerated the trend toward higher compression ratios in 1947, when he demonstrated before the Society of Automotive Engineers that a car with 12 to 1 compression ratio had a greatly improved fuel economy, equivalent to a saving of at least 30 per cent.

The change in compression ratio for 10 years just past is shown in Fig. 1. Projection of this curve to 1980 tells us that we can expect a ratio of 13 to 1 by then, if not sooner. This will depend, of course, on having gasoline of the proper octane rating available at the filling stations. The trend of gasoline octane rating for the past ten years, also shown in Fig. 1, is also projected to 1980, indicating that we can expect to have the desired fuel at that time if past performance is any criterion. When piston gasoline engines have reached this stage of development, the passenger car will be operating with a power plant having a fuel economy comparable to that of Diesel engines and free piston engines. The fuel requirement, however, will be quite different. Whereas the Diesel engine operates on kerosene or Diesel engine fuel, the high compression gasoline engine of 12 to 1 compression ratio will require a fuel not at present available at filling stations, but which will have an octane rating which, on the basis of the present octane scale, will be equivalent to 110-120 octane. Fig. 2 compares the fuel economy of a Diesel engine with that of a 10 to 1 compression ratio gasoline piston engine.

As a result of improved fuel economy, lower unit weight, and lower unit size, the gasoline piston engine will be in a strong position to retain its place as the power plant for the future automobile. Referring again to the comparison between the characteristics of the various engines, we have Fig. 3 this time in the form of a bar chart showing the best fuel economy, pounds per horsepower, and cubic feet per 100 horsepower of the nine different engines that were compared in Table 1.

If we consider that the most desirable engines are those having the shortest bar height in the three categories shown, then it is obvious that the gasoline engines are in the most favorable position, especially the engines built with a large proportion of aluminum. These show better fuel economy, weight, and space re-

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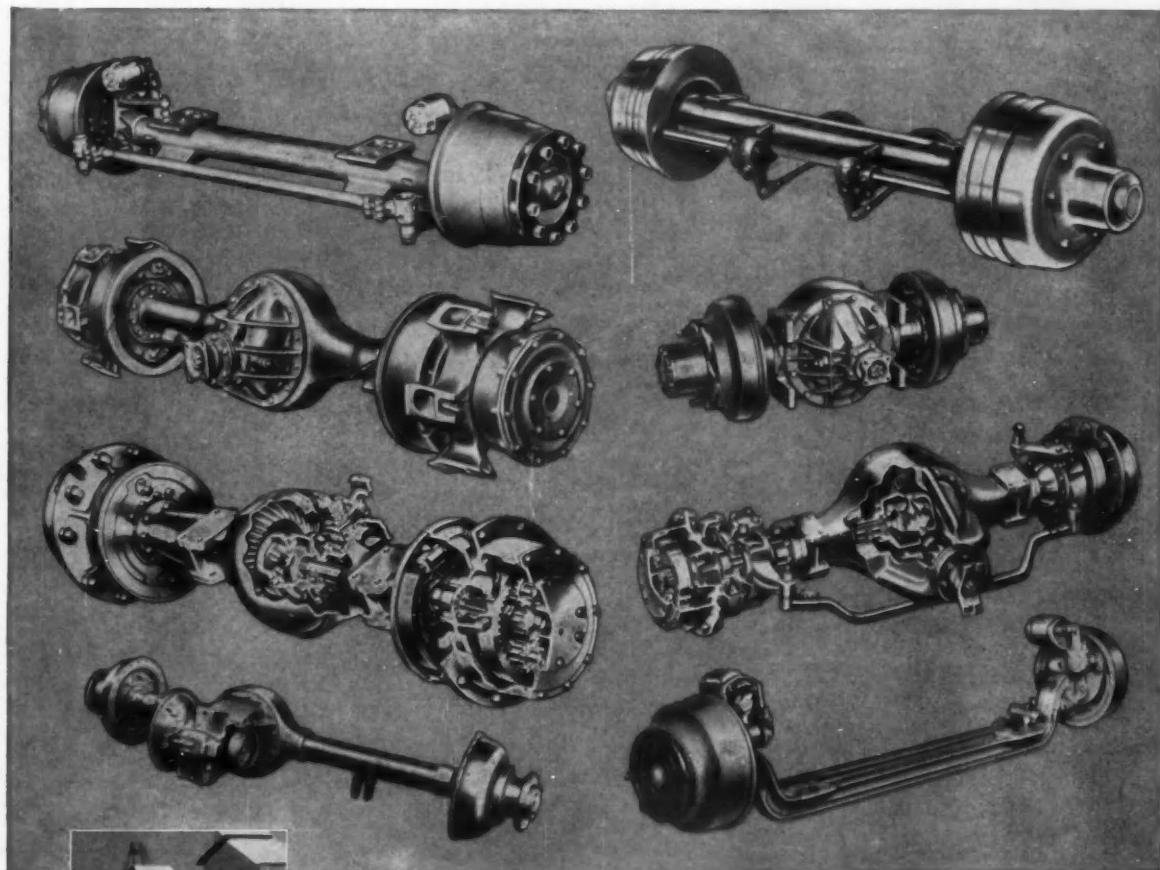
What are your requirements? We can build Radiators to your order in any type, to any size or shape. Send us your blueprints for prompt quotations!



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for CARS, TRUCKS, TRACTORS and SPECIAL APPLICATIONS.

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## A flattering thing to say for any working vehicle **CLARK AXLES!**

Champions, they say—athletes or revenue vehicles—are as young as their legs; which explains quickly why Clark-equipped vehicles grow old profitably—their "legs" stay young.

Clark builds axles for every type of commercial vehicle

- **trucks and buses**—rugged, easy-to-steer front axles; driving axles, steering and non-steering
- **trailers**—light, rigid, tough axles of high carbon steel tubing; spindles forged integral
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**axle-transmission drive units for agricultural and industrial applications**

- **fork-lift trucks**—axles designed for materials handling equipment
- **housing**—light, exceedingly strong, one-piece forging, heat-treated

What is your need in that vital area of "durable legs?" In Clark axles you get the solid cash benefits of 50 years concentration on transmitting horsepower to wheels: efficiently, economically, durably.

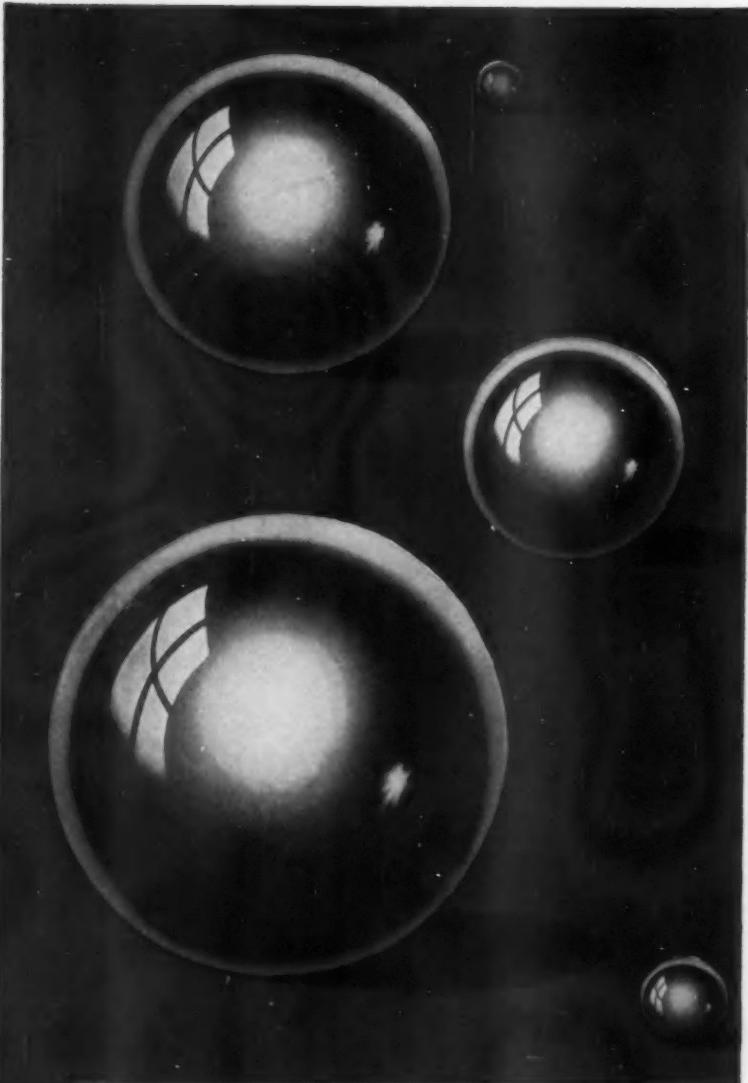
A handy-sized Clark Products book is yours on request; indicates several reasons why leading manufacturers find it good business to do business with CLARK.

**CLARK EQUIPMENT COMPANY, Buchanan 2, Michigan**

**OTHER PRODUCTS OF THE CLARK AUTOMOTIVE DIVISION—**  
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## COOLIDGE *Balls*

CHROME ALLOY AND STAINLESS

COOLIDGE CORPORATION  
MIDDLETOWN, OHIO

quirement than any of the other engines.

Added to that, all of our manufacturing plants are tooled for production of this type of engine, so that introduction of a radically different engine would involve stupendous costs. There is no doubt, however, that the money for such retooling would be certainly spent just as soon as some other type engine showed a clear advantage over the present day engine.

The trend for the next 15 years then would appear to be toward higher compression ratios and the use of more aluminum and magnesium. In this period, we can also expect ventures involving gas turbines or free piston engines, probably at first in sports cars. We can also consider the possibility of turbo supercharging in commercial engines and sports cars to do two things:

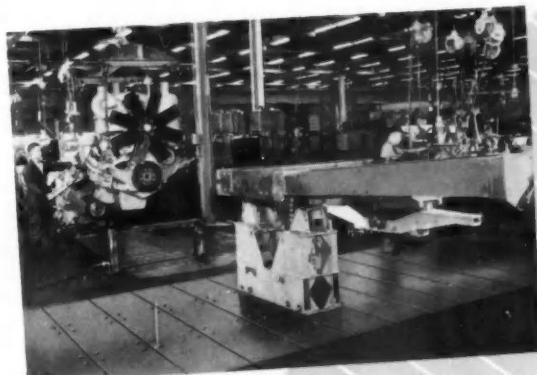
1. To get better fuel economy.
2. To get increased horsepower per unit of size.

Passenger cars run at reduced load too much of the time to make turbo charging profitable.

The race between the present type engine, the gas turbine, and the free piston engine will be interesting and exciting. Size, weight, and performance of the gasoline piston engine, which must be improved upon by the gas turbine or the free piston engine if they are to displace the piston engine, are targets that will not stand still. Improvements we can see coming up make it appear that piston engines will be our power plants for many years to come.

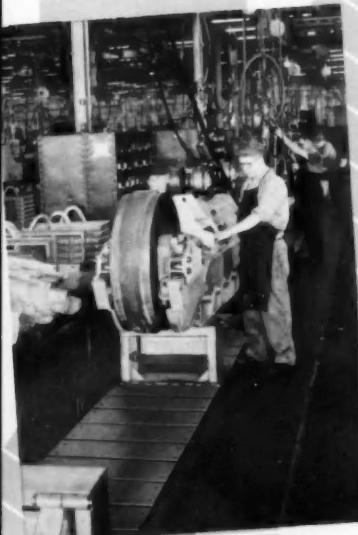
*The foregoing article consists of extracts from the paper, "Materials in the Automobile of the Future," which was presented by Mr. Boegehold at a recent meeting of the American Society for Testing Materials in Cleveland and on June 14 at the First Annual Detroit Conference on Tooling and Materials at Wayne University.*

It is estimated that a new industry coming into a community and employing 150 men would mean an average plant investment of \$200,000 and provide an annual payroll of \$500,000. It would also serve as the major support of 33 retail establishments, maintain a 33-room schoolhouse with 18 teachers, and be the means of support of approximately 1000 people. By the same token, it would mean sales and services for 450 automobiles.



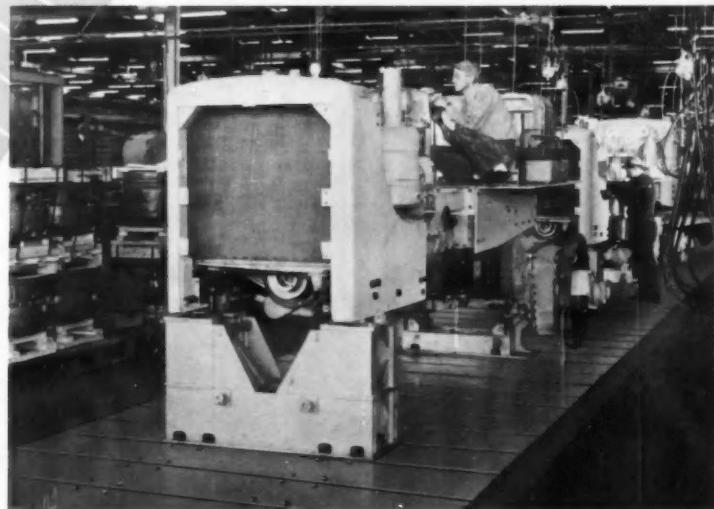
Engine feeder line . . . completely assembled engine being transferred to final assembly line.

## Conveyors Carry 40,000 pound Caterpillar-built Tractors



Track roller frame assembly line . . . unit in foreground is ready for assembling to tractor.

**WRITE FOR:**  
Catalog 50 . . . Trolley Conveyors  
Catalog 51 . . . Floor Conveyors  
Catalog 52 . . . Power & Free Conveyors



Tractor at end of assembly line . . . ready for roller frame assemblies and tracks.

To obtain maximum production of the world's largest track-type tractors, Caterpillar Tractor Co. has installed in its Peoria plant a system of Webb slat conveyors that serves as assembly lines. The main assembly line, which is a slat conveyor 9 feet wide and over 320 feet long, is one of the largest conveyors of this type in the world. Tractors assembled on this conveyor line average approximately 40,000 lbs. each.

Three other slat conveyors, also flush-floor-mounted, complete the tractor assembly system. One conveyor is used for feeding engines to the main line and the other two for assembling track roller frames. Each of the four conveyors is installed and fixtured to automatically carry the assemblies from one operation to another and keep work at the most convenient height.

Large and small industries throughout the world, for over 35 years, have been using Webb engineering skill, manufacturing experience and installation ability to solve every type of materials handling job. We will welcome an opportunity to discuss your needs or problems.

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*in a new car — in a used car —*

# **STAINLESS STEEL**

## **Sells and Re-sells!**



**McLOUTH**  
STAINLESS  
**STEEL**  
for automobiles

The Stainless Steel trim, molding and vital parts that add style and beauty to a car, inside and out, are features that help make the sale.

Stainless Steel has wide customer acceptance. It's easy to clean and keep clean. It's a tough, solid metal that will not corrode or dent and stands up to gravel, ice, salt and water.

The finish never fades and parts are easy to replace. Stainless Steel lasts the life of the car. It *sells* in a new car and it *re-sells* in a used car.

**McLOUTH STEEL CORPORATION, Detroit, Michigan, Manufacturers of Stainless and Carbon Steels**



*This Month's*  
**GEAR PIX**



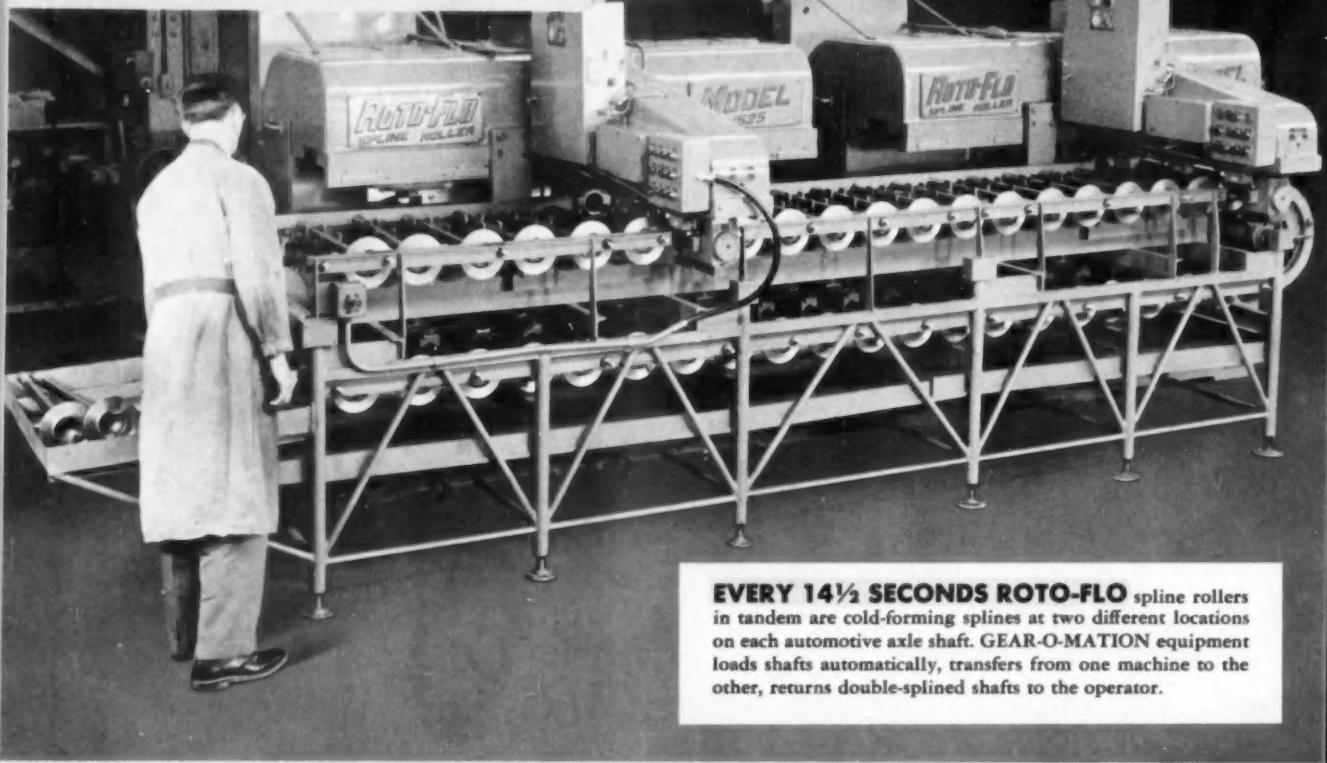
**LATEST GEAR-O-MATION®** equipped Michigan 870 gear shaver finishes 18-tooth automotive pinions at 260 per hour. Features are: hopper feed, automatic load and unload, pneumatic headstock and tailstock, 3-way classifier with automatic feedback maintaining correct center distance, desired accuracy and production requirements preset on control panel, more accurate gears produced.



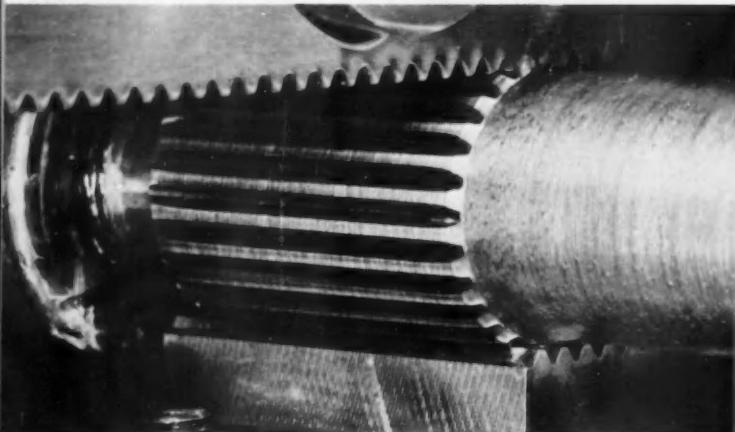
**MACHINE TOOL BUILDER** shaves a wide variety of gears (a few are shown) on this Michigan 870-A gear finisher. Underpass is used for shoulder cluster gears, while the transverse method, in combination with crowning, is favored for shaving wide face spur and helical gears. This 870-A has an 18-inch capacity, which covers practically all requirements for this Illinois firm.

**MICHIGAN  
TOOL COMPANY**  
7171 E. McNICHOLS RD. • DETROIT 12, MICH.  
IN CANADA: COLONIAL TOOL CO., LTD.

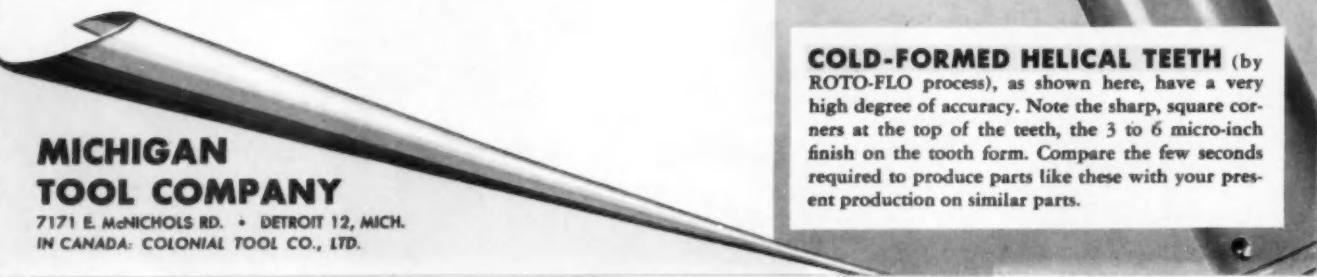
*This Month's*  
**GEAR PIX**



**EVERY 14½ SECONDS ROTO-FLO** spline rollers in tandem are cold-forming splines at two different locations on each automotive axle shaft. GEAR-O-MATION equipment loads shafts automatically, transfers from one machine to the other, returns double-splined shafts to the operator.



**ROTO-FLO FORMED SPLINES**, just coming off the forming racks. Actual forming process takes 4 or 5 seconds—floor to floor time is 10 to 15 seconds. Cumulative spacing error is less than .0015 inch—compare it to your present spline manufacturing.



**MICHIGAN  
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**COLD-FORMED HELICAL TEETH** (by ROTO-FLO process), as shown here, have a very high degree of accuracy. Note the sharp, square corners at the top of the teeth, the 3 to 6 micro-inch finish on the tooth form. Compare the few seconds required to produce parts like these with your present production on similar parts.

## Adhesives, Coatings, Sealers

(Continued from page 100)

ing. They are particularly adaptable to applications wherever faying surfaces must be sealed against leakage.

The weld-through sealer is applied with a hand caulking gun to truck roof. Immediately after the sealer is applied, the metal drip molding is joined to the roof section by spot welding. Welds are made directly through the sealer.

To seal the area where the truck roof is joined to the cab body, the weld-through sealer is applied by knife coating to one of the metal surfaces. The roof and body are joined by spot-welding on approximately three-inch centers.

In bonding flat-type sponge rubber weatherstrip to painted truck cab door frames, a brush coat of adhesive EC-524 is applied by hand around one-half of the door frame and the uncoated weatherstrip is then pressed in place. The second half of the door frame is next brush-coated and weatherstrip pressed into contact. In this manner, the adhesive does not dry out before the weatherstrip is applied.

When dried, adhesive EC-524 produces a bond that is firm and tough yet flexible and rubbery. It is highly resistant to water, and has good strength and flexibility over a temperature range of minus 30 F to 180 F.

To insulate against noise, Mack sprays a tough sound deadening coating, EC-1189, to the interior front, rear roof and side panel sections of bus bodies. This material is also sprayed on the roof, door panels and backs of truck tractors and tractor cabs. These sections are all coated prior to the painting operation.

The coating also helps resist corrosion resulting from condensation on the underside of metal roofs. It tends to retard heat transfer through the metal and thereby reduces corrosive condensation.

The Diamond T Motor Car Co. uses adhesives for adhering sound deadening and insulating pads, sponge rubber weatherstrip and rubber floor mats to truck cabs in its Chicago plant.

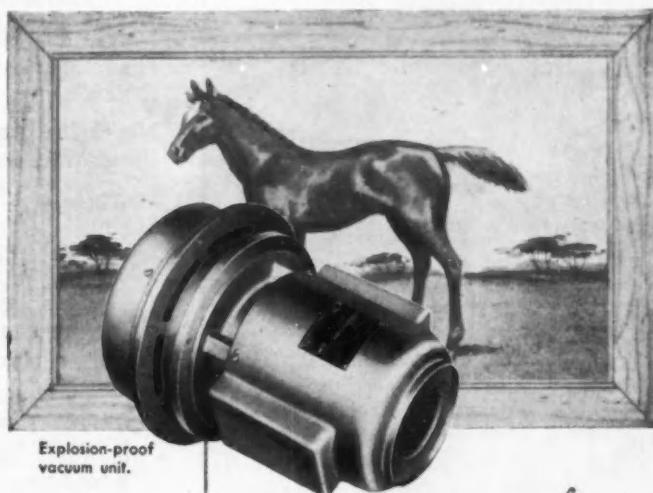
A water-dispersed, synthetic rubber based 3M adhesive called EC-871 is applied by brush to the interior roof surface of truck cabs. Then, while still wet, a  $\frac{1}{4}$ -in. thick fibrous glass sound damping and insulation pad is pressed into place. This same

adhesive is used in a similar manner for attaching a vinyl coated jute insulating and decorative pad to the interior, back and side panels of cabs.

Another 3M adhesive, EC-882, is used for applying uncoated sponge rubber weatherstrip to enameled steel doors and door frames as well as adhering rubber floor mats to painted steel truck decks. This is a high strength adhesive for this type of application. It has the additional combined features of easy handling, and good resistance to water, oil and gasoline.

The adhesive is applied by either flowing into place with an oil can type applicator or by brush. The weatherstrip is then pressed in place while the adhesive is still slightly wet but exhibiting some tack.

When used in bonding rubber floor mats, EC-882 is brushed to the center section of the cab floor. When the adhesive becomes tacky, the rubber mat is pressed into contact. The floor mat installation is made after the truck cab is mounted on the chassis, and is one of the last production operations.



## Thoroughbred *Fractional* HORSEPOWER for your motor-driven products



Aircraft windshield wiper motor.



A rugged high-torque, high-speed motor.

The unexcelled performance of Lamb Electric Motors in many types of industrial, commercial and domestic products is evidence of their outstanding quality.

Dependability and efficiency (optimum weight-size-horsepower ratio) are features that result from proper design and careful manufacture by personnel having many years of experience in the small motor field.

May we demonstrate how Lamb Electric Motors can bring these advantages — and also perhaps lower costs — to your products?

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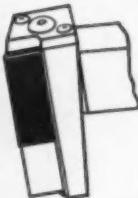
SPECIAL APPLICATION  
FRACTIONAL HORSEPOWER MOTORS

# VR

# TOOLHOLDERS CUT

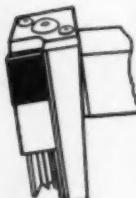
**Savings Range from 10% to 200%!**

**V-R Longhead Toolholders Eliminate Carbide Waste**

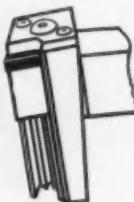


V-R longhead elevator type toolholders will handle any standard cemented carbide inserts up to 1½" in length.

This insert has been reground as many times as possible for use in ordinary toolholders.



In a V-R toolholder, the insert can be reground until it is no longer thick enough to take the cut required.



**V-R toolholders** cost less to use because of unique design features not found in any others:

**Less Downtime** because you do not have to reposition the toolholder when you replace or index inserts. Change of inserts is fast and easy — there are no loose pieces to fall out.

**Lower Carbide Cost.** You can consume up to 90% of a long insert, nearly twice as much as with other toolholders.

**No Grinding** when you use V-R toolholders and throw-away inserts.

**Long-Life Chipbreakers.** V-R chipbreaker plates are made of a special cast alloy (not steel), chosen for its exceptional wear and shock resistance characteristics.

**NEW CATALOG FREE ON REQUEST**

... new Catalog No. VR-437 gives complete data on the design and construction of all V-R toolholders  
... contains dimensional drawings, parts lists and prices. Also describes V-R carbide inserts in grades to meet your needs. Get your copy now. Call your V-R Representative or Distributor, or write to Vascoloy-Ramet Corporation, Waukegan, Illinois.



## Styles to handle 90% of Your Machining Operations

**Standard Brazed Tool**



AR-AL

**Comparable Toolholder**



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**Standard Brazed Tool**



D

**Comparable Toolholder**



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**45° Lead Angle Turning**

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**15° Lead Angle Turning**

FR-FL



TFPR-TFPL



**Straight Facing**

E



TDTR-TDTL



**30° Lead Angle Turning**

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Insert is clamped between adjustable elevator and fixed position chipbreaker plate. That's all there is to it!

Insert is removed and replaced in seconds. It is automatically indexed just by slipping it in place!

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Yes, it does — when you automate with *standard* Baker Basic machines. They cost much less than a machine specially built for only one part . . . and pay off quicker. For example, a manufacturer recently installed 3 Baker Basics on relatively low-production jobs. He estimates that the savings through automatic operation will pay for the machines in 3 years or less. Ultimately he will incorporate these Baker Basics into a transfer machine. Baker Basics can be retooled with comparative ease and at less expense. They needn't be completely "rebuilt" for a change in product or production method. For drilling, boring, tapping and other machining operations. In 5 sizes.



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COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

## Premix Molded Polyester Parts for Automobiles

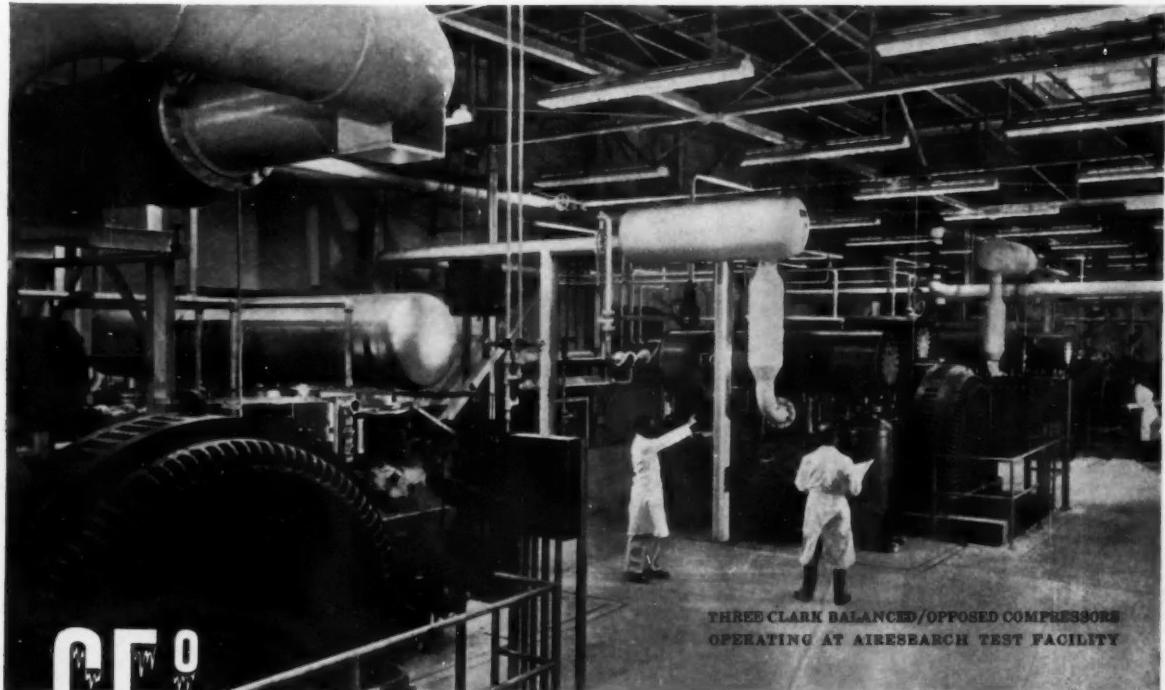
(Continued from page 64)

are used. The reinforcing fibers must be short to permit random orientation and thus prevent formation of directional planes of strength.

Woodall makes the premix compound in a practically continuous operation. The polyester resin is pumped from stainless steel storage tanks to the mix room, where it is blended with the catalyst, mold lubricant and other liquid ingredients. The liquid blend is then brought together with the dry ingredients (fiber, filler and pigment) in a high speed mixing mill which ejects the finished mix onto a conveyor. The material is carried to a line of weighing stations where a group of operators form the compound into balls of a specified weight. Alternatively, the premix may be sent through an extruder, where it is shaped into bar form and then cut into billets of the proper weight.

Although the Paraplex resin cures quickly in the mold, the catalyzed resin in the premix is highly stable at room temperature. This permits temporary stockpiling of preformed material to keep ahead of production.

One of Woodall's big applications for this process is the enclosure and ducting for the Chrysler heater-defroster units. Originally designed as a spot-welded steel assembly, these enclosures would have required 15 major stampings and 100 additional parts with attendant sealing and fitting problems. The possibilities of production economy by making these housings by a one-shot molding process were highly attractive, but there was a question whether premix molded parts would be rugged enough to withstand the vibration and weight of the fan, motors and other elements. It was found that by increasing the cross-section thickness of the molding enough to produce good sound deadening properties, the sisal-fiber material gave adequate strength for the application. As finally designed the housing is molded in two pieces. One is a 5.6 lb molding for the engine side of the firewall, which combines the ducting, heat coil cover, and support for the fan and motor. The second piece is a 2.8 lb molding, consisting entirely of ducting for the passenger side.



THREE CLARK BALANCED/OPOSED COMPRESSORS  
OPERATING AT AIRESEARCH TEST FACILITY

CF 0  
b5

## below zero in the middle of the desert

*Clark Air Compressors furnish the power*

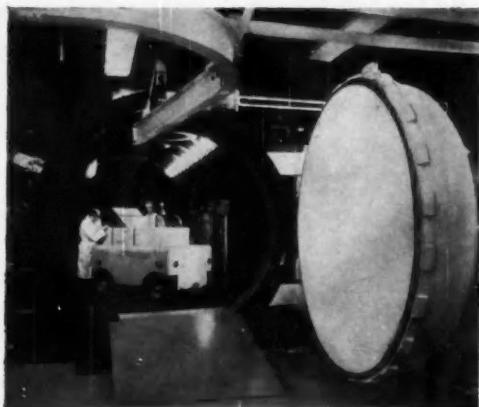
Mass production testing of aircraft components such as air turbine starters, refrigeration turbines and other units was what the AiResearch Division of the Garrett Corporation wanted. To meet this need, they built giant test facilities next to their factory in the middle of the Arizona desert at Phoenix featuring seventy-five test cells.

To provide most of the air to operate test equipment AiResearch installed three Clark Model CRA-4 Balanced/Opposed Motor-Driven-Compressors having a combined rating of 4750 horsepower. Up to 42 tons of air per hour can be delivered. Temperatures range from a frigid  $-65^{\circ}$  to a blistering  $1000^{\circ}\text{F}$  while pressures of from vacuum to 1000 psi can be provided.

For your air needs in the 150-4500 horsepower range, Clark has an ultra modern Balanced/Opposed Compressor to fit every application. Your nearest Clark representative will give you complete information or write for Bulletin 118.

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Offices in Principal Cities Throughout the World



GIANT ALTITUDE CHAMBER FOR HOT AND COLD TESTS



Balanced/Opposed  
Air Compressors

# Austin Makes Own Transfer Machines

(Continued from page 61)

For small angles of tilt, spacer wedges are fitted under either the column or the slide base. Large angles are handled by special adjustable bases of low-cost construction. These consist of a triangular foundation supporting an inclined member which pivots at one end and is secured by struts of variable length at the other. Fine angular alignment is made with

an eccentric shaft. The base can be mounted either on a branch bed or at floor level.

The center beds, supplied by Archdale, are in two- and three-station sections bolted together to the required length. Most of the transfer machines at Austin are of the platen type with a fixture attached to each platen. Moved by a hydraulically-

driven transfer bar, they index the fixed distance of three feet between stations, where location is by upward clamping. Platens are used in order to increase the versatility of the standard equipment, since many small and irregular-shaped parts, such as crankshafts and manifolds, as well as engine blocks and heads, are machined on these transfer lines.

Several features have been developed to improve the operation of this construction. Horizontal rotation of the platen at the required stations permits machining alternate sides of the work. When there is an abnormally long operation at one station, a system of double indexing leaves the work in place for twice the normal cycle time while the other platens move forward. For this, two adjacent stations duplicate the operation.

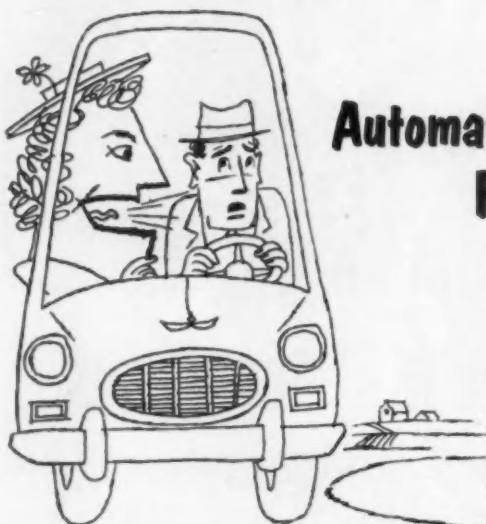
Chip clearance is effected by passing the fixture and work through an enclosed station which blows compressed air from three jets while the platen rotates. To save floor space, empty platens are returned to the head of the line on conveyors running alongside the center bed through apertures in the horizontal branch beds.

Austin has now built over 60 in-line transfer machines and some 45 rotary indexing automatics, most of which are installed at the Longbridge plant, with many also in operation at other factories of the British Motor Corp. Tool design and manufacture have been largely the responsibility of H. W. Holbeche. One of the largest unit-constructed transfer lines at Longbridge has 32 stations for machining four-cylinder engine blocks. It is 108 ft long, has 51 heads with a total of 167 work spindles, and an output of 400 blocks per shift.

Elsewhere there are a number of unusual setups and attachments based on the standard unit heads. For example, cylinders are finish-bored on a special 12-station, triple-indexing machine with vertical spindles. Here blocks are clamped in pairs, and individual cylinders are bored two at a time at each two-spindle station. Six blocks are completed in each six-minute cycle, giving an effective output of one per minute. Cylinders are then wire-brushed, and finally rolled.

All four-cylinder crankshafts are drilled on a group of platen-type lines. Angular oil holes in the crank pins are competitor on a 14-station machine. At the first station the work is at right angles to the tool for dimpling, after which the fixture indexes through 30 deg for the next six progressive drillings with reciprocating feed. It then

## Automatic Reminder For Motorists



### FASCO LOW OIL PRESSURE INDICATING SWITCH

The NEW FASCO "451" may be small; but . . . to the car owner, its essential protection against trouble and costly repairs is a BIG factor. And being a FASCO product, its unfailing dependability can be taken for granted. Sales-minded engineers are first to recognize its importance.



ON PUBLIC CARRIERS, the FASCO "451" also meets the need for a warning indicator of low pressure in the air-brake system. Remember . . . where dependability and economy in automotive design count, IT PAYS TO . . .

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# Young Radiators

cool engine "horses" supplying  
the go-power, the lift-power



Front view of Young stamped tank radiator used on HiDuty Lift Trucks.

HiDuty Lift Truck Model 200W is one of several models using engine-cooling Young radiators.

## Young engine-cooling radiators tailored for every automotive application

Power to lift, power to move . . . both depend on the horsepower harnessed in HiDuty Lift Trucks. For these engine "horses" to meet rugged requirements of day in and day out service, they must be kept cool . . . and cooled they are by Young radiators. HiDuty and many others in the automotive field are convinced that Young radiators are *best* to use wherever the going is tough! Patented features insure maximum heat transfer and give Young cores a dependable ruggedness. Specify Young radiators for efficient engine cooling for cars, buses, trucks, tractors, locomotives, and stationary applications.

**Put Young Talent  
to work for you . . .**

Solving heat transfer problems is what we do best because it is our very reason for being. You, too, can harness the power of Young engineering talent. Write, wire or call without obligation.



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Give your Diesel fuel injection equipment positive protection against damage caused by minute dust and abrasive particles. Install American Bosch "FSA" Final Stage Fuel Oil Filters. They cost just a few dollars, yet contain an improved water-resistant filtering material that traps all particles that get through primary and secondary filters. The sealed construction is tamper-proof . . . installation is quick, easy, inexpensive.

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### SHEET METAL SPECIALTY DIVISION



Box 567—Follansbee, W. Va.

A Division of

**FOLLANSBEE STEEL CORPORATION**

Follansbee, W. Va.

indexes back through 60 deg for the remaining holes. At the final station it rotates to the original position where the work is cleaned and unloaded.

Indexing during transfer is effected by rollers on either side of the fixture striking cam plates on the center bed. A small spring-loaded plunger locates the indexing plate at each station, and is withdrawn during rotation by a roller contacting a fixed cam plate. Clamping is by a diaphragm cylinder acting on a plunger in the fixture base.

Three such machines are in use, two for the 73.2/91.5 cu in. A40/A50 engine crankshafts, and one for the 48.8 cu in. A30 units. There are two additional transfer lines for drilling the rear flanges and front ends of these two different types.

For gearbox casings there is a 17-station machine whose first operation consists of milling the irregular inside rear face. Here the unit head is required to traverse a complex lateral path, and for this purpose it is mounted on two inclined hydraulic slides on the same plane, supported on a transverse slide.

After the head is fed into depth against a fixed stop, the movement for profile milling is controlled by dogs on each slide actuating appropriately spaced and inter-connected limit switches, which in turn operate solenoid valves. In effect, the shape followed by the cutter spindle is a resultant of the two movements. To prevent accidental damage to the aluminum casting caused by overrunning the required profile, at the rear of the head there is a fixed internal cam with a roller engaging its inside surface during the milling operation.

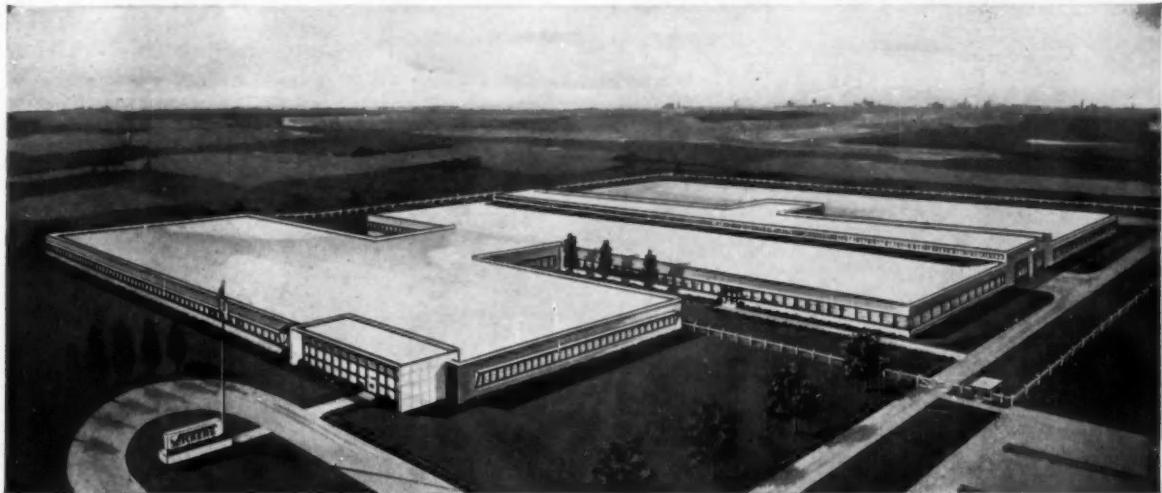
Farther along the same line are two stations for slot milling on the outside rear face of the casing. The unit heads, carried on vertical slides, are given a reciprocating action through an eccentric arm driven by worm gearing from the main spindle.

Exhaust manifolds are machined on a seven-station unit that mills the faces for joints, flanges and carburetor mounting, and drills all holes, with tapping as required. Similarly, induction manifolds are handled on a six-station machine. A further point of interest in this case is the safety measures installed on an experimental basis to comply with Britain's stringent Factory Act. This stipulates (but does not as yet enforce) protective guards for transfer lines.

Here the entire machine is encircled



**NEW ADMINISTRATIVE  
and  
ENGINEERING CENTER**



**Dedicated to the Development  
and Improvement of  
Hydraulic Components and Systems**

Vickers, a pioneer in oil hydraulics for a wide variety of uses, has maintained leadership through the years by means of aggressive and extensive research.

Continuing rapid expansion of the oil hydraulics requirements of industry has brought with it the need for augmented research and engineering facilities. To meet this need, Vickers has just completed this new building in suburban Detroit . . . 150,000 square feet devoted entirely to research, development, engineering application and administration.

A milestone in Vickers progress, this new Administrative and Engineering Center is also a promise of future benefits to users of Vickers hydraulic components and systems.

**VICKERS INCORPORATED**  
DIVISION OF SPERRY RAND CORPORATION

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7385

*Engineers and Builders of Oil Hydraulic Equipment Since 1921*

by two sets of light beams and photoelectric cells with angled mirrors at each corner. Interruption by a worker of the outer screen around the extreme perimeter causes a horn to sound and danger signals to light up giving a warning that someone has entered the danger area. The inner beams flank the tools, and when any of these are broken the power is cut off and the machine stops.

One of the many rotary automatics built with standard heads and circular center beds is a machine with seven working stations for transmission

shifter forks. This has a pair of two-position fixtures at each station, and with double-indexing the table rotates twice for one complete cycle. Thus one fully-machined fork is unloaded each time the table indexes.

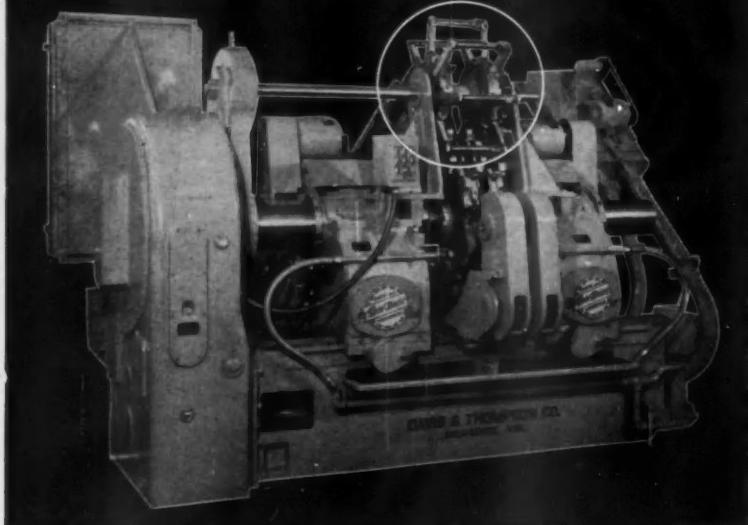
Austin's current expansion program calls for a considerable number of additional transfer lines, some of which are already being installed or tested at the factory. Mr. Holbeche indicated that the trend is now towards non-platen types of lines for certain components, to facilitate automatic loading and unloading. These

machines will be linked up with the live storage conveyors already in use, and will require no operators. The latest to be completed is a 36-station line for A40/A50 engine blocks, where the operations include boring the cam-shaft and crankshaft bearings. This will parallel the existing block line and thus double the output.

Planning engineers at Longbridge are looking ahead to further automation as techniques are perfected and suitable equipment becomes available. Turning and grinding are envisaged as operations that could be included in a normal transfer cycle, as is complete machining of gears, including cutting, tooth chamfering, grinding and lapping.

When production requirements are small, it is felt that several different components could be handled on the same platen-type machine by using interchangeable fixtures. These would be loaded consecutively, with each fixture selecting its own appropriate units and tools by means of trips and dogs as it indexed through the line. Another possibility is the automatic loading of work pieces into fixtures.

## ...Milling and Centering Steering Gear Shafts at the Rate of 360 Per Hour



This continuous type milling and centering machine has been furnished with an automatic unloader (indicated by circle) which transfers finished parts onto a conveyor or discharge chute. Milling and centering of both ends is done simultaneously and in continuous production.

Basically, this is a standard ROTO-MATIC machine toolled-up to handle special production requirements. Rough and finish milling and centering spindles in both heads have micrometer endwise adjustment. Heads are adjustable on the ways. With equalizing jaws in fixtures plus chain clamping, machine is fully automatic.

If you have work of this nature, consult D&T engineering for further details.



Davis and Thompson Co.

4460 N. 124th St. MILWAUKEE 10, WISCONSIN

## MEN in the NEWS

(Continued from page 41)

Willys-Overland Export Corp.—M. A. van Merkenstein has been elected a vice-president.

Caterpillar Tractor Co., Ltd.—G. Geoffrey Deakin is now marketing manager.

Hamilton Standard Div., United Aircraft Corp.—Wilson M. Alford was promoted to senior project engineer in pneumatics.

Bendix - Westinghouse Automotive Air Brake Co.—John E. Jardine has been named service sales manager, and Clarence A. Jarosz has been chosen general service manager.

Boeing Airplane Co.—Arthur T. Curren has been made manager of military sales.

Lockheed Aircraft Corp.—J. Russell Daniell was named chief project engineer for military models, and Arthur E. Flock was chosen chief project engineer for commercial models.

Aerojet-General Corp.—Kenneth F. Mundt has been promoted to vice-president.

Motor Wheel Corp.—John A. Hannah was elected to the board.

(Turn to page 162, please)

Crankshaft Machine Company  
uses La Salle's

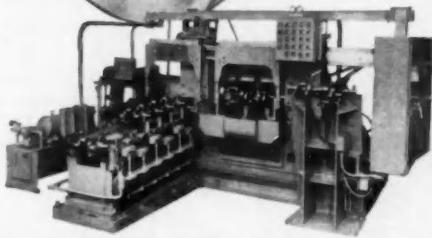
# NEW

fatigue-proof

## STEEL BARS

to replace heat-treated alloy

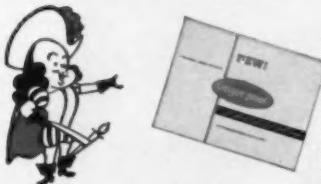
- 140-150,000 PSI TENSILE
- MACHINES 50-100% FASTER



FATIGUE-PROOF is specified in this automated turning machine manufactured by Crankshaft Machine Company, Jackson, Michigan.

### NEWLY PUBLISHED!

Ask for your copy of this 20-page booklet which gives detailed information on the remarkable new FATIGUE-PROOF . . . 29 pictures, tables, charts.



**La Salle STEEL CO.**  
1438 150TH STREET, HAMMOND, INDIANA

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of Quality Cold-Finished Steel Bars

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City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



(Continued from page 37)

Westinghouse Electric Corp. will spend more than \$1 million this year to expand and improve manufacturing facilities at its East Pittsburgh, Pa., plant.

\* \* \*

Convair Div. of General Dynamics Corp. is said to be ready to go ahead with production of Skylark jet airliners.

\* \* \*

Soviet Government has changed the name of the Molotov Automobile factory to Gorky Auto Works. It is now producing the Volga car.

\* \* \*

Bostrom Manufacturing Co. is conducting a study of the effects of ride vibration on human beings.

\* \* \*

Remington Arms Co. has entered into an agreement to purchase Mall Tool Co. . . . Dow Chemical Co. has taken an option to buy Bay Refining Corp. and its affiliate Bay Pipe Line Corp.

\* \* \*

Pittsburgh Screw & Bolt Corp. has agreed to buy the machinery and customer relationships of the Fastener Div. of Oliver Iron & Steel Corp.

\* \* \*

Pesco Products Div. of Borg-Warner Corp. has opened offices in Los Angeles, Seattle, and Wichita, Kan., to handle direct sales of its fuel pumps, hydraulic pumps and other products.

\* \* \*

Allegheny Ludlum Steel Corp. has completed a new induction vacuum melting department at its Watervliet, N. Y., Works.

\* \* \*

Penna. R. R. recently took its new lightweight Keystone train, built by Budd Co., on a trial run.

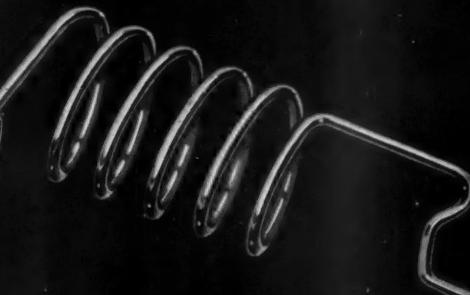
\* \* \*

Union Carbide & Carbon Corp. plans to build two new plants to produce low-pressure polyethylene plastics.

\* \* \*

Brown Trailers, Inc., has installed a new electrical system for their trailers that uses circuit breakers instead of fuses.

(Turn to page 176, please)



# Accurate

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This is an Accurate Spring! It's different than the rest, because it's *designed* and *engineered* for its job. It has been *created* by Accurate's skilled craftsmen who approach all spring problems with experience . . . and imagination.

When YOU need the best of springs, held to the closest tolerances and manufactured at the lowest cost — YOU need Accurate!

# Accurate



## Springs

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SPRINGS  
WIRE FORMS  
STAMPINGS

# HARRISON AIR-CONDITIONS THE FIREBIRD II!



## GM's Revolutionary Gas Turbine Car Features HARRISON Air-Conditioning!

New highway horizons . . . and Harrison handles the cooling! The comfort and convenience featured in the advance design of GM's new experimental Firebird II, is backed by a wealth of creative planning and years of progressive engineering and research. It's only natural that Harrison, with over 45 years of automotive heat transfer experience, should be called on to solve the problem of air-conditioning this out-ahead dream car. Manufacturers know they can depend on Harrison to come up with the answers to *tomorrow's* problems. And they can rely on Harrison for top advances *today*. For example, new low-cost, "out-in-front" Harrison air conditioning is tailor-made for today's Buick, Oldsmobile, Pontiac and Chevrolet.

If you have a cooling problem, look to Harrison for the answer.

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N. Y.

TEMPERATURES

MADE

TO

ORDER



# HARRISON

## News of the MACHINERY INDUSTRIES

(Continued from page 79)

mitments for 1958 models probably will not be coming for several months yet, but machine tool builders are not too concerned about that. The decline in orders from car makers is being offset by increased orders from other industries seeking to cut manufacturing costs.

The Government also is stepping

up its plans to purchase machine tools to increase productive capacity. According to the Office of Defense Mobilization, the U. S. will spend between \$40 million and \$50 million on new machines, which it will lease to companies engaged in work on marine turbines and gears.

Although shipments of new machine tools have not climbed at the same rate as new orders, they are still markedly above last year. For the first five months shipments rose 29 per cent to \$341.9 million compared with \$265.8 million in the like

period last year. The backlog of unfilled orders last month (June) stood at \$800 million and is expected to remain at a high level through the end of the year, despite increased work schedules by many machine tool builders.

### Two New VP's



Charles M. Reesey has recently been elected vice president of Cincinnati Milling and Grinding Machines, Inc.



A. H. Dall, new vice president of Cincinnati Milling and Grinding Machines, Inc.

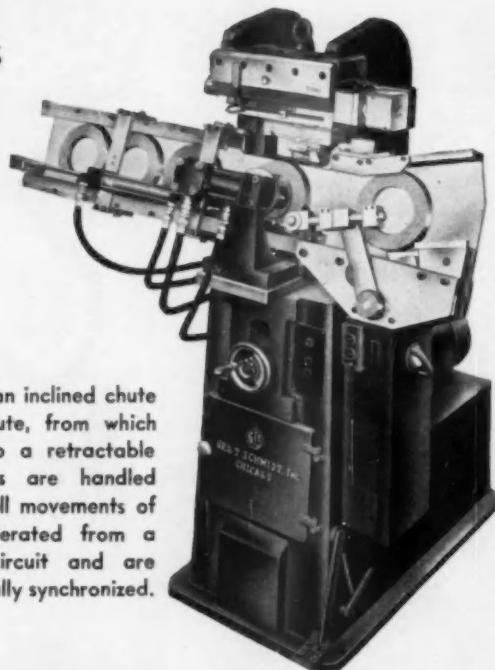
## RING GEAR MARKING? IT'S FAST, ACCURATE, FULLY AUTOMATIC

WITH THIS



Model 175-S

This **GTS** machine marks ring gears with serial numbering, fixed marking, or both in one operation. It is fully automatic, requiring no operator for loading, work, or discharge. Production rate is 1600 per hour.



Parts are fed from an inclined chute to the machine chute, from which they are loaded to a retractable stud arbor. Gears are handled swiftly and safely; all movements of the fixture are operated from a master hydraulic circuit and are therefore automatically synchronized.

FOR FURTHER INFORMATION on this machine, or expert assistance with any industrial marking problem, consult your nearest **GTS** representative, or write direct.

**IF IT'S WORTH MAKING,  
IT'S WORTH MARKING.**

**GEO. T. SCHMIDT, INC.**

4110 Ravenswood Avenue Chicago 13, Illinois

Charles M. Reesey and A. H. Dall were recently elected vice presidents of Cincinnati Milling and Grinding Machines, Inc., sales subsidiary of The Cincinnati Milling Machine Co. Mr. Reesey has been advertising manager of The Mill since 1934 and is given credit for widening that de-

# FULL PHASING

comes to the one-way clutch



from  
**BORG-WARNER**

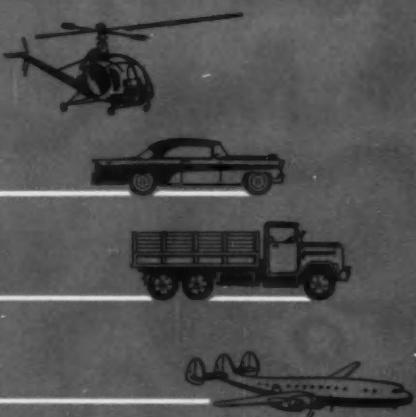
"design it better-  
make it better"

engineering



Benefiting almost every  
American every day.

# BORG-WARNER



Automotive and aircraft applications present special problems for one-way sprag clutches. For example, how to utilize their high theoretical torque-carrying capacity, and how to insure dependable operation under conditions of high shock loading and torsional vibration.

To solve these problems, Borg-Warner's Spring Division has engineered and perfected the first Double Cage *Full Phasing* One-Way Sprag Clutch. Designed for heavy duty service in the toughest applications, this new full phasing feature assures instantaneous engaging and uniform release of all sprags, full theoretical torque carrying capacity, high free wheeling speed without wear, long trouble-free operation.

Light, compact and readily adaptable to low-cost mass production, this new B-W full phasing clutch is performing successfully in automatic transmissions, torque converters, free-wheeling, overrunning and indexing devices and other applications.

It is one more example of how Borg-Warner's "design it better - make it better" policy serves American industry every day.

THESE UNITS FORM BORG-WARNER, Executive Office, 310 S. Michigan Ave., Chicago  
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INGERSOLL KALAMAZOO • INGERSOLL PRODUCTS • INGERSOLL STEEL • LONG MANUFACTURING  
MARSHON CHEMICAL • MARVEL-SCHEBLER PRODUCTS • MECHANICS UNIVERSAL JOINT • NORGE  
PESCO PRODUCTS • ROCKFORD CLUTCH • SPRING DIVISION • WARNER AUTOMOTIVE PARTS  
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## by FAIRFIELD

GEAR PERFORMANCE to match the ever-increasing power and speed of modern machines is Fairfield's specialty. This is possible because Fairfield has constantly held a position of leadership in utilizing the most advanced methods, machines, and techniques for producing better gears. By keeping apace with modern engineering trends, Fairfield renders an invaluable service to many of the nation's leading machinery builders: "Gear Performance Made to Order!"

Users also get the advantage of Fairfield's mass production economy extending over a complete range of gears: Spiral Bevel, Straight Bevel, Hypoid, Zerol, Spur, Herringbone, Worms and Worm Gears, Splined Shafts, and Differentials. Available, too, are expert recommendations for any gear problem users may have. Ask for interesting, illustrated bulletin describing Fairfield facilities.

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MANUFACTURING CO.



2303  
S. Concord Rd.

Lafayette,  
Indiana

partment's activities to make it the largest of its kind in the machine tool industry. Mr. Dall has been director of standard machine tool engineering since 1951.

### Bliss Executive Changes

At a recent meeting of the board, directors of E. W. Bliss Co. approved the appointment of Howard U. Herrick to the newly created office of chairman of the board. In this new capacity, Mr. Herrick will serve as the chief policy-making officer of the firm. Robert Potter, former executive vice president, has been appointed to the position of president. Mr. Potter was also elected a director and a member of the executive committee. J. H. Tredinnick, who had served as executive vice president, director, and member of the executive committee has resigned from these positions but will continue with the company as consultant to the president.

### MEN in the NEWS

(Continued from page 156)

Ford Motor Co., Special Products Div.—Eldon E. Fox is now advertising manager.

Continental Screw Co.—Anthony J. Pelson is now assistant sales manager in charge of distributor sales.

Rivett Lathe & Grinder, Inc.—John A. Marsh was named vice-president in charge of air and hydraulic sales.

Vickers, Inc.—Thomas B. Doe, Jr., has been made manager of export sales, and Russell Dupuis has been chosen plant manager of the Omaha Production Div.

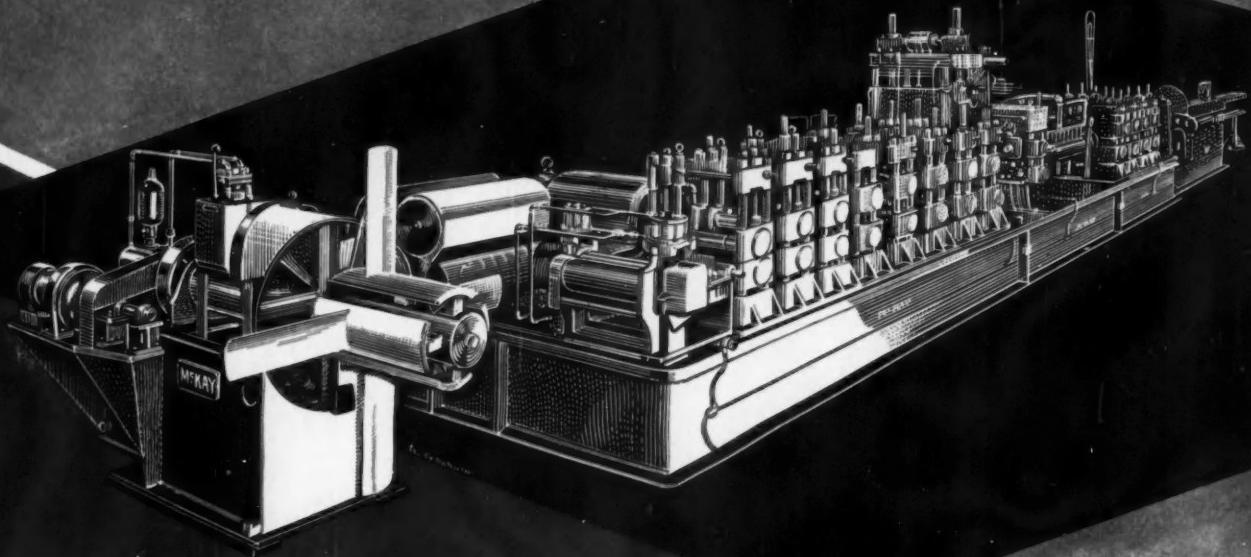
Motch & Merryweather Machinery Co.—Leonard A. Rafferty has been chosen manager of the Pittsburgh, Pa., office.

Klemp Metal Grating Corp.—Dan W. Oram is now executive director of sales.

Hydro-Aire, Inc.—Lt. Gen. Laurence C. Craigie (USAF, ret.) has been appointed vice-president of engineering.

Piasecki Aircraft Corp.—Robert G. Kutzer has been elected assistant trea-

International Nickel Co., Inc.—Albert P. Gagnebin and Harold Larsen have been made manager and assistant manager, respectively of the Nickel Sales Dept.



# McKay

## Resistance Weld Tube Mills . . .

FOR THE MOST EFFICIENT  
TUBE MAKING IN THE INDUSTRY

MCKAY MILLS are recognized throughout the tube and pipe making industry as the finest equipment available. Users have found McKay gives more machine for the money — that the slight extra cost of these rugged machines is more than repaid in long trouble-free service that results in real efficiency. McKay designs and builds tube and pipe mills in all sizes.

**The McKay Machine Company, Youngstown, Ohio.**

9966

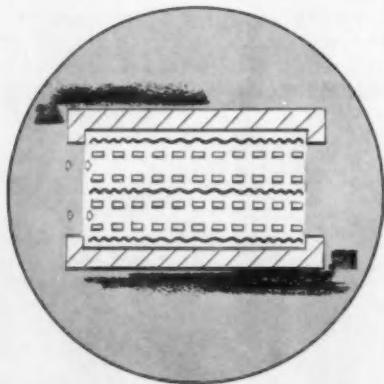
SETTING THE STANDARDS OF QUALITY IN METAL WORKING MACHINES FOR TWO GENERATIONS

# BRAND NEW - MODERN ELECTRIC ELEMENT

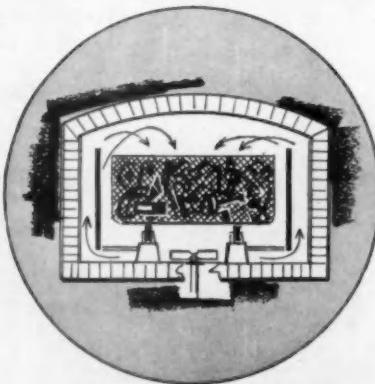


This shows graphically how the new Lindberg CORRTHERM electric heating element actually fills the furnace with walls of glowing heat. Note also that CORRTHERM is conveniently hung

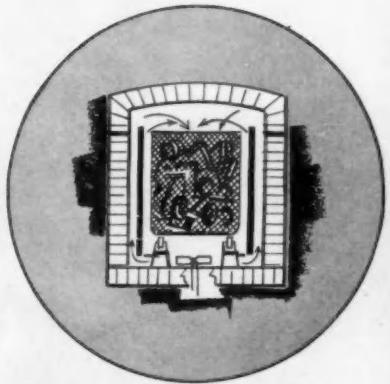
from simple brackets requiring no complicated connections or construction. This element operates at extremely low voltage, eliminating shock or short hazards.



In continuous type furnaces CORRTHERM elements hang between lines of work as well as on side walls. Note how closer corrugations (at each end of element) compensate for incoming cold work and door losses.



CORRTHERM elements act as natural baffles to direct forced convection streams through the charge. The use of electric furnaces for carburizing and carbonitriding now becomes completely practical.



No retort needed in pit-type carburizing furnace with CORRTHERM elements. Again see how elements serve as baffles to direct forced convection stream through charge.

# FOR LINDBERG FURNACES

Never before has there been an electric heating element like this CORRTERM by Lindberg. Its revolutionary advantages now make the use of electricity as the source of heat, practical, efficient and economical for all heat treating processes.

Ideal for use in any electric heat treating furnace, CORRTERM elements have particular advantages for carburizing and carbonitriding. This new element completely eliminates problems formerly created by the use of electricity in these types of furnaces. These exclusive advantages of CORRTERM explain how and why:

**LOW VOLTAGE:** Operates at extremely low voltage. No leakage through carbon saturation. Around Lindberg we talk about it as the electric element "without any electricity . . . to speak of!"

**ATMOSPHERE CIRCULATION:** Elements act as baffles to direct circulation of convection streams.

**SAFETY:** Extremely low voltage also eliminates shock or short hazards.

**DURABILITY:** Watts density at all-time low. Element practically indestructible. Work load or operator's charging tool can't hurt it.

**EASILY INSTALLED:** Element is not enclosed, just hangs in furnace. No complicated mountings required.

If electricity is the preferable source of heat for your metal treating processes find out how advantageously CORRTERM elements can be applied to your requirements. Just get in touch with your nearest Lindberg Field Representative. (Consult your classified phone book.)

## LINDBERG LINDBERG ENGINEERING COMPANY

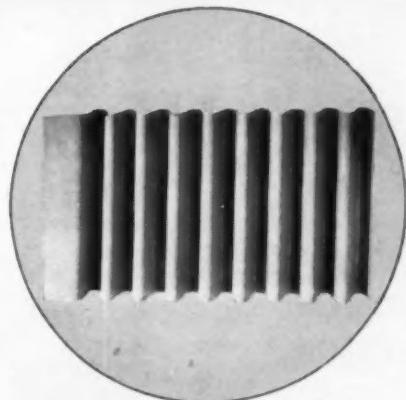
2491 West Hubbard Street, Chicago 12, Illinois

Los Angeles Plant: 11937 South Regentview Avenue, at Downey, California

Associate Companies: Lindberg Industrial Corporation, Chicago • EFCO-Lindberg, Ltd., Montreal, Canada  
Lindberg Italiana, Milan, Italy • The Electric Furnace Company, Ltd., Weybridge, Surrey, England  
Etablissements Jean Aubé, Paris, France • Lindberg Industrie Ofenbau, Gross Auheim, Germany



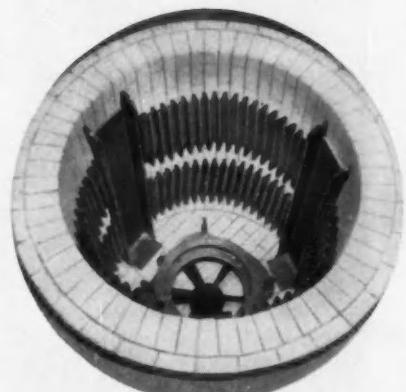
Safety! Extremely low voltage makes CORRTERM elements completely safe. Let operator or work load bang it if they will. Neither element nor operator will be hurt.



CORRTERM elements are large sheets of corrugated nickel chromium. They were developed in Lindberg laboratories by Lindberg metallurgists and engineers.



This shows installation of CORRTERM elements in one of two large rotary furnaces currently being erected in the field by Lindberg's associate company, Lindberg Industrial Corporation.



An installation of CORRTERM elements in a carburizing pit-type furnace. Simplicity of mounting makes replacement easy and economical.

# CORRTERM

by LINDBERG

## New Defense Facilities

SUPPLEMENTING the list of Certificates of Necessity issued up to May 16, authorizing new or expanded defense plant facilities for the manufacture of automotive and aviation war goods which was published in the June 15 issue, page 124, of AUTOMOTIVE INDUSTRIES, the following additional certificates were announced by the Office of Defense Mobilization,

covering the period which extends from May 17 to June 13, inclusive.

The figure appearing in parentheses is the percentage authorized in respect to actual fast tax write-offs.

**AIRCRAFT ENGINEERING PRODUCTS, INC.**, Clifton, New Jersey  
Military aircraft parts—\$34,341 (70)

**AMERICAN BOSCH ARMA CORP.**, Garden City, New York  
Research and development—\$879,471 (60)

**AMERICAN WELDING & MANUFACTURING CO.**, Warren, Ohio  
Military aircraft engine parts—\$136,190 (70)

**AXELSON MANUFACTURING CO.**, Div. of U. S. Industries, Inc., Montebello, Calif.

Military aircraft parts—\$852,405 (40)

**BELL AIRCRAFT CORP.**, Wheatfield, New York  
Military aircraft—\$153,388 (65)

**BENDIX AVIATION CORP.**, Research Laboratories Div., Oakland Co., Michigan  
Research and development in military electronics—\$2,000,000 (40)

**BENDIX AVIATION CORP.**, Scintilla Div., Sidney, New York  
Military aircraft parts—\$241,025 (65)

**CURTISS-WRIGHT CORP.**, Cameron and Clearfield Counties, Pa.  
Research and development—\$4,520,964 (75)

**CURTISS - WRIGHT CORP.**, Propeller Div., Caldwell Township, N. J.  
Military aircraft parts—\$33,492 (65)

**DOUGLAS AIRCRAFT CO., INC.**, El Segundo, Calif.  
Research and development—\$8,170,000 (80)

**FAIRCHILD ENGINE AND AIRPLANE CORP.**, Fairchild Guided Missiles Div., Wyandanch, L. I., New York  
Military electronic systems—\$137,061 (65)

**FAIRCHILD ENGINE & AIRPLANE CORP.**, Stratoc Div., Bay Shore, L. I., New York  
Military aircraft components—\$44,462 (65)

**GENERAL DYNAMICS CORP.**, Convair Div., San Diego, Calif.  
Research and development—\$5,313,184 (145)

**HUGHES AIRCRAFT CO.**, Culver City, Calif.  
Military electronic equipment—\$683,637 (65)

**HYDRAULIC RESEARCH & MANUFACTURING CO.**, Burbank, Calif.  
Military aircraft parts—\$17,197 (70)

**LOCKHEED AIRCRAFT CORP.**, Bakersfield, Calif.  
Military aircraft—\$246,964 (65)

**GLENN L. MARTIN CO.**, Baltimore, Maryland  
Military aircraft—\$516,427 (60)

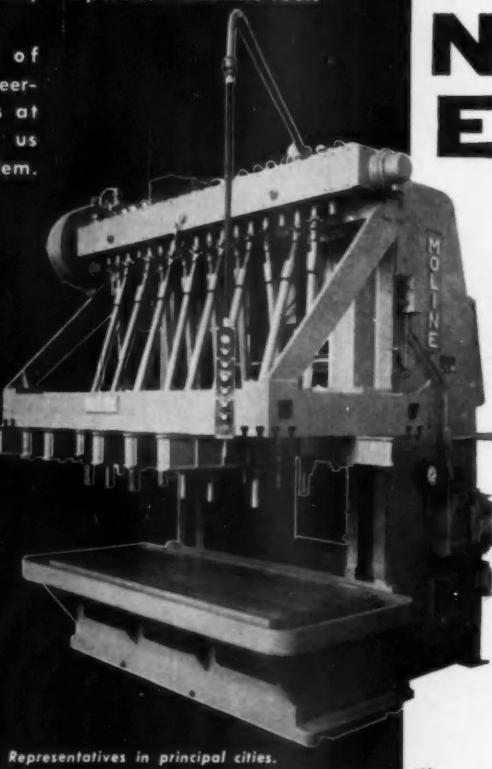
**THE RYAN AERONAUTICAL CO.**, San Diego, Calif.  
Military aircraft—\$170,000 (65)

## FOR GREATER . . . PRODUCTION • EFFICIENCY • SAVINGS

Use an individually designed "Hole-Hog" Machine Tool for such jobs as:

- Multi-Spindle Boring
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

Over 50 years of  
Machine Tool Engineering  
experience is at  
your service. Tell us  
your particular problem.



HU68 drilling machine  
with fourteen spindles  
adjustable in a 72 inch  
by 24 inch drilling  
area. Other sizes  
available.

Representatives in principal cities.

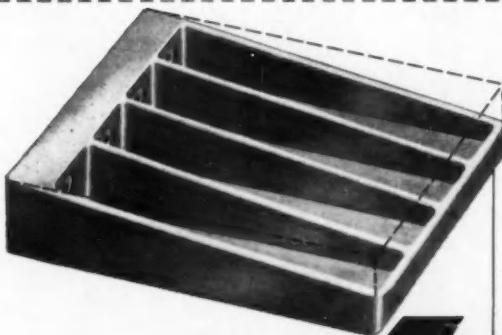


**MOLINE TOOL COMPANY**  
100 20TH STREET      MOLINE, ILLINOIS

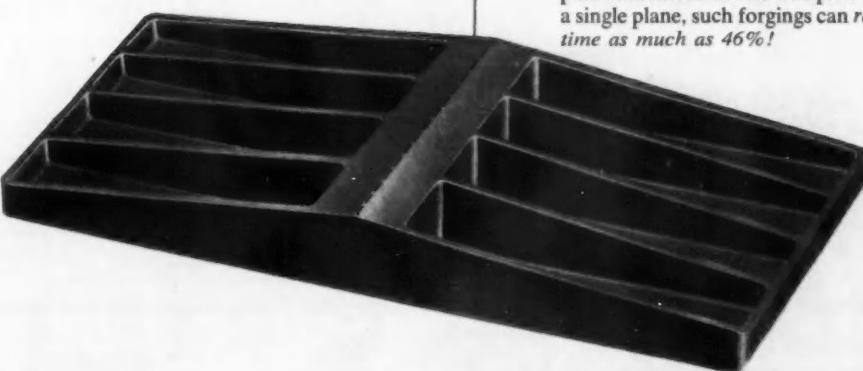
## BOOKS . . .

**AIRCRAFT PRODUCTION METHODS**, by Gordon B. Ashmead, published by Chilton Co., Chestnut and 56th Streets, Philadelphia 39, Pa. Price, \$7.50. This is a comprehensive treatment of the various production methods in use in the aircraft industry today, from the development of the design to the final assembly. The author takes the reader on a behind-the-scenes tour through some of the leading airplane plants in the country, where he explains all the important phases of production, beginning with the master plaster pattern; going through the foundry, where dies to form metal are made; and from there to the forming machines, the drop hammer, the stretch press, which turn sheetmetal stock into aircraft parts. Advanced methods of heat treatment are discussed as well as the different methods of preparing surfaces to withstand the elements. Over 300 official photographs aid the reader in following the text, which is written in a clear, understandable style for the general reader.

Harvey precision forgings...  
fewer machining hours,  
more flying hours



This is the old way of making an aileron actuator attach fitting . . . machining it from aluminum billet stock. It has three drawbacks. First, it adds many hours to plane construction time . . . second, it requires specialized, expensive machinery . . . third, it can waste up to 90% of the metal.



Here's a Harvey *precision* aluminum forging, two fittings produced as one piece, then cut apart. Zero draft eliminates slow, costly counter-boring or back spot-facing . . . forging to finished-part dimensions avoids complex machining. On a single plane, such forgings can *reduce machine time as much as 46%*!

*Harvey is a leading independent producer of aluminum extrusions in all alloys and all sizes, special extrusions, press forgings, hollow sections, structurals, rod and bar, forging stock, pipe, tube, impact extrusions, aluminum screw machine products and related products. Also similar products in alloy steel and titanium on application.*

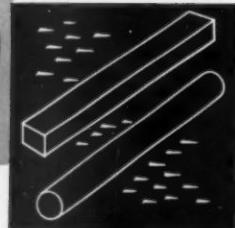
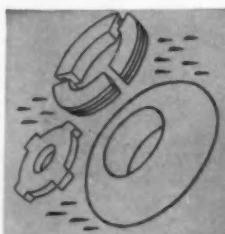
MAKING THE MOST OF ALUMINUM . . . FOR EVERYONE

**HARVEY**  
**Aluminum**

HARVEY ALUMINUM SALES, INC., TORRANCE, CALIFORNIA—BRANCH OFFICES IN PRINCIPAL CITIES

### MECHANICAL SHAFT SEALS

New Stackpole oil seals greatly reduce pitting, blistering, spalling. Many other types for use with air, gases, corrosive chemicals and other liquids.

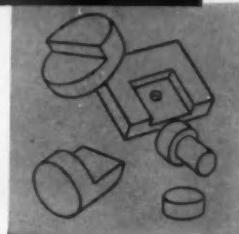


### MAXIMUM SALT BATH RECTIFICATION

Stackpole Carbon Rods in electric salt bath furnaces avoid decarburization. Heating is fast and uniform. "Drag out" is minimized, electrode life increased.

### RESISTANCE WELDING and BRAZING TIPS

... that last 3 to 4 times as long. Stackpole "F" treatment minimizes oxidation, reduces dressing by  $\frac{1}{3}$ , assures longer life.

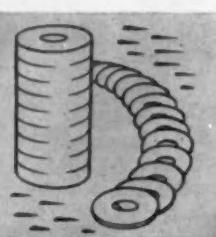


## STACKPOLE CARBON-GRAPHITE materials and components

Boost Efficiency • Reduce Costs

### POROUS CARBON that is 75% AIR

A typical example of carbon versatility, this new Stackpole material has many potential uses as filters, etc. Has high electrical conductivity and high resistance to chemical attack. Is stable at high temperatures.

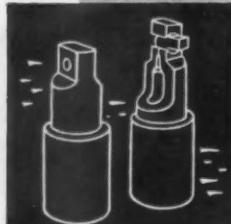


### FOR CRITICAL VOLTAGE CONTROL

Stackpole Carbon Discs (piles) offer maximum control efficiency as pressure-sensitive resistance elements over a broad range of critical voltage control work. Write for catalog.

### EASY SOLUTIONS TO MOLD and DIE PROBLEMS

Carbon molds and dies are readily formed or machined. Extremely high heat capacity plus ability to maintain strength at elevated temperatures makes them ideal for foundry, glass molding, powder metallurgy and other uses.



**STACKPOLE CARBON COMPANY • St. Marys, Pa.**

OTHER STACKPOLE PRODUCTS INCLUDE: BRUSHES for all rotating electrical equipment • carbon-graphite and metal powder ELECTRICAL CONTACTS CHEMICAL ANODES • CATHODIC PROTECTION GROUND RODS • BRAZING BOATS and TRAYS • BEARINGS • TUBE ANODES • FRICTION SEGMENTS • CLUTCH RINGS • PUMP VANES • WELDING CARBONS • RESISTANCE WELDING and BRAZING TIPS • SPECTROGRAPHITE • ELECTRIC FURNACE HEATING ELEMENTS • WATER HEATER and PASTEURIZATION ELECTRODES . . . and many more.



## NEW ERA OF E-X-P-A-N-S-I-O-N

(Continued from page 48)

300,000 persons. By 1960, it is estimated, a monthly average of from 435,000 to 450,000 workers will be required, with a maximum of 630,000 workers during the summer months.

The American Road Builders Association recently issued a comprehensive report on the ability of the highway construction industry to execute a long range national highway program. Of particular interest is the

TABLE II

### Additional Equipment Required for \$1.0 Billion of Net Highway Contract Construction

(For annual work volumes in excess of \$5.8 billion)

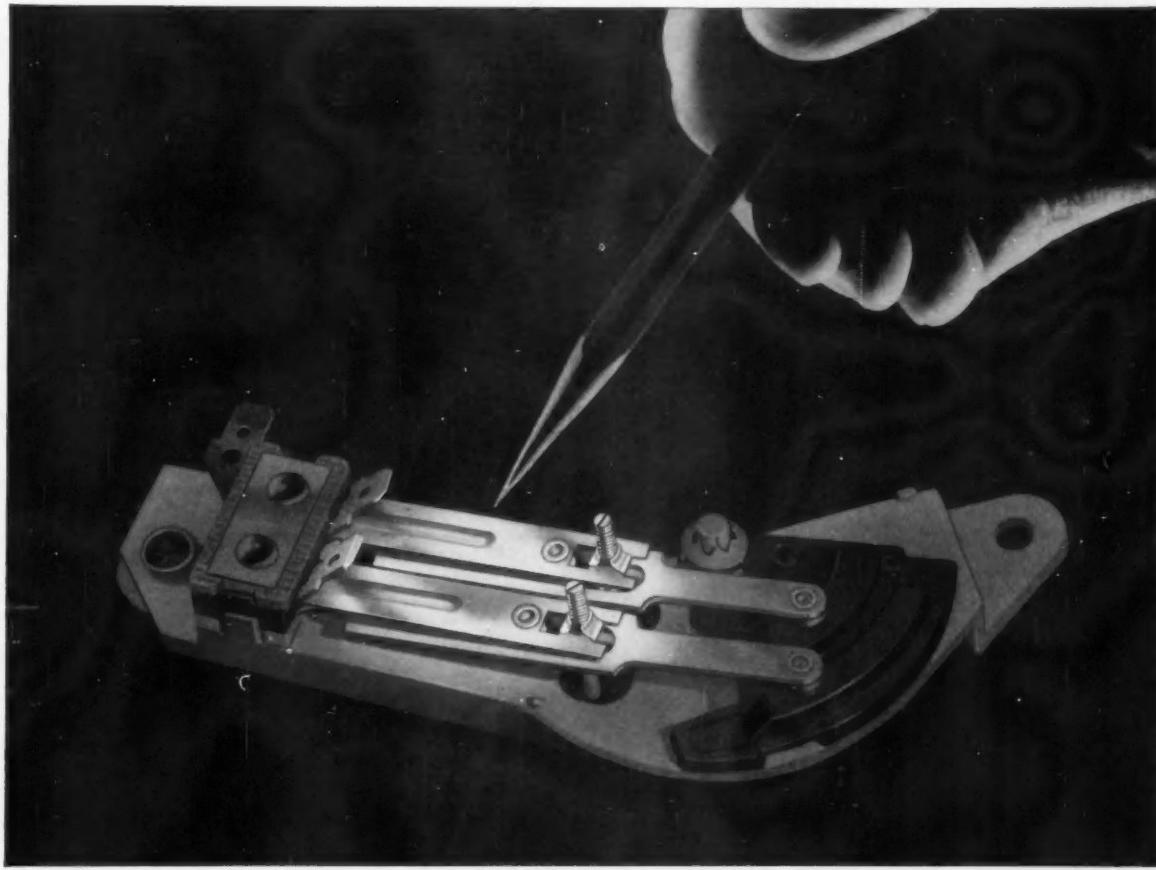
Description	No. Units
<b>Construction Machinery and Allied Equipment</b>	
Tractors, Crawler(1)	4,500
Tractors, 2 and 4 Wheel (Contractors Type)	3,000
Scrapers, Hauling (All Types)	3,200
Off-highway Hauling Equipment (End, Side and Bottom Dumps)	1,800
Power Cranes & Shovels	3,000
Motor Graders	2,500
Rollers, All Types	2,500
Loaders, Front End, Wheel	1,600
Ditchers & Trenchers	250
Hydraulic Hoists & Dump Bodies(2)	(16,000)
Air Compressors, Portable	2,250
Batching Plants, Concrete	300
Concrete Mixers, Portable	1,200
Contractors Pumps	2,340
Concrete Pavers	150
Concrete Spreaders	175
Concrete Finishers	175
Truck Mixers & Agitators	1,500
Asphalt Plants, Portable	200
Bituminous Pavers (Spreaders-Finishers)	300
Bituminous Distributors, Truck Mounted	250
Crushing & Screening Plants, Portable	250
Miscellaneous Units (10%)	3,144
<b>Subtotal</b>	<b>34,584</b>
<b>Motor Vehicles</b>	
Pickups & Autos	2,600
Trucks, 1½-3 Tons	9,600
Trucks, over 3 Tons	8,500
Trucks, Miscellaneous	1,800
<b>Subtotal</b>	<b>22,500</b>
<b>Grand Total</b>	<b>57,084</b>

(1) Including attachments and power control units.

(2) Not in total, included as integral parts of trucks and off-highway hauling equipment.

study made by Task Force No. 4 under the chairmanship of Frederick Salditt, vice president of the Harnischfeger Corp. in evaluating the requirements for road construction machinery, earthmoving machines, and other equipment.

In its survey this group tabulated 330,648 major units of road construction equipment available January 1, 1956, as compared to 303,472 units a



**Engineered by Tinnerman...**

**ONE SPEED CLIP® REPLACES 3 PARTS...**

**SIMPLIFIES ASSEMBLY... and saves money!**



General Electric's Housewares & Radio Receiver Division, Bridgeport, Connecticut, adopted this one-piece, multiple purpose SPEED CLIP and made profitable savings in the new G-E Automatic Coffee Maker.

Engineered by Tinnerman specially for the thermostat control, each SPEED CLIP replaces three parts—a blade, a bushing, and a lock nut. Controls are now assembled

faster, easier, with improved line flow. There are fewer parts to buy, stock and handle... and unit cost has been reduced, too.

Find out about a free Tinnerman Fastening Analysis Survey. It can point the way to more efficient fastening on your assembly line. Get complete information from your Tinnerman representative or write direct for Fastening Analysis Service Bulletin No. 336. There's no obligation.

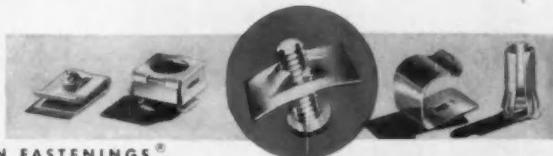
**TINNERMAN PRODUCTS, INC. • Box 6688, Dept. 12, Cleveland, Ohio**

*Canada: Dominion Fasteners, Limited, Hamilton, Ontario. Great Britain: Simmonds Accessories, Limited, Treforest, Wales. France: Aerocoissoires Simmonds, S. A., 7 rue Henri Barbusse, Levallois (Seine). Germany: Hans Sickinger GmbH "MECANO", Lemgo-i-Lippe.*

**TINNERMAN**

**Speed Nuts®**

FASTEST THING IN FASTENINGS®



year earlier for the 1955 program. The various types of units and number available for the 1956 program are listed in Table 1. The big increases in inventory took place in wheel tractors and hauling scraper equipment.

In Table 2 is itemized the additional new equipment required for each \$1.0 billion of new highway contract construction. The total is estimated at 57,000 units, with a value of approximately \$0.5 billion, which are capable of producing \$6.9 billion worth of contract construction during

their expected life. The group states that an annual increase of over \$1.2

**TABLE III**  
**Federal Funds for Interstate Highway Systems**

Fiscal Year	Authorization	Fiscal Year	Authorization
1957	\$1,000,000,000*	1964	\$2,200,000,000
1958	1,700,000,000	1965	2,200,000,000
1959	2,000,000,000	1966	2,200,000,000
1960	2,200,000,000	1967	2,200,000,000
1961	2,200,000,000	1968	1,500,000,000
1962	2,200,000,000	1969	1,025,000,000
1963	2,200,000,000		\$24,825,000,000

\* In addition to the \$175 million already authorized for 1957.

billion over the \$7.3 billion program potential of presently available equipment would require additional manufacturing capacity.

In recent years great strides have been made increasing the capacities and mechanization of highway construction equipment. One notable advance has been torque converter drives. Higher horsepower has been provided in the various types of equipment, particularly in earth moving units. A measure of the increased productivity of highway construction equipment is the number of employees per \$1.0 billion of highway contracts. In 1955 the number was 52 per cent of the total per \$1.0 billion in 1948. The report also states that constant improvement in pneumatic tires has provided many units with increased flotation and higher operating speeds. Cited improvements in motor trucks are increased horsepower, greater payloads without increase in chassis weight, improved rear axles, and tubeless tires.

## ROTABS Beat Precision Inspection Costs . . .



This 24" ROTAB plus centering fixture cuts checking time for 11 dimensions on six vane segments from several hours to 5 minutes each.



Checking big jet engine assemblies is fast and simple on ROTABS (36" & 48"), eliminates costly fixtures made obsolete by engineering changes.



Seconds-of-arc precision allows quick, accurate inspection with low cost standard gages. Here 36" powered unit checks vane spacing.



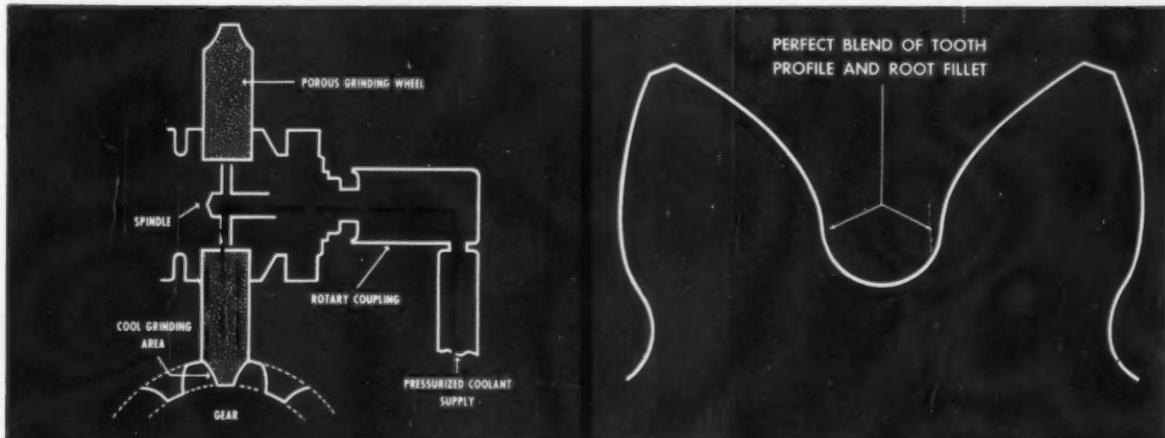
For small parts inspection this 12" universal ROTAB minimizes setup and inspection time, does not require power for tilting and rotation.

For complete data on the optical precision readings you get with the ROTAB at the lowest cost, write:

**MACHINE PRODUCTS CORP.**  
6771 East McNichols Road      Dept. A      DETROIT 12, MICH.

# These Unique Features

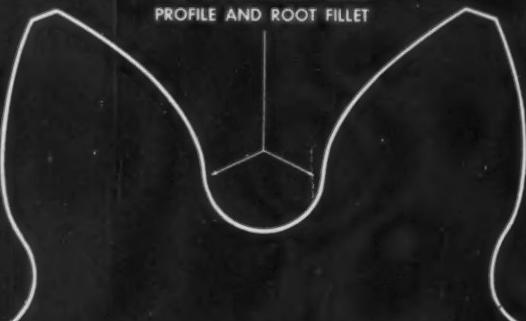
## MAKE PRECISION GRINDING OF GEARS MORE PROFITABLE THAN EVER BEFORE



### NON-TEMPERED, CASE-HARDENED GEARS

A controlled flow of coolant through the grinding wheel is supplied to the area between the grinding wheel and the gear tooth. This feature, coupled with the automatic down feed, virtually eliminates surface tempering and grinding checks.

### PERFECT BLEND OF TOOTH PROFILE AND ROOT FILLET



### PERFECT BLENDING OF FILLET AND PROFILE

Single or double diamond trimmers are used to assure a perfect blend between the tooth profile and the root fillet. This eliminates stress risers at the critical section of the tooth.



### 19 Gear Grind Machines are used in the production of the Pratt & Whitney J-57

At Pratt & Whitney Aircraft, where finest quality gears and high production are essential to the manufacture of the J-57 Turbojet, 19 new automatic Gear Grind Machines are in daily use. Here is what Pratt & Whitney has to say:

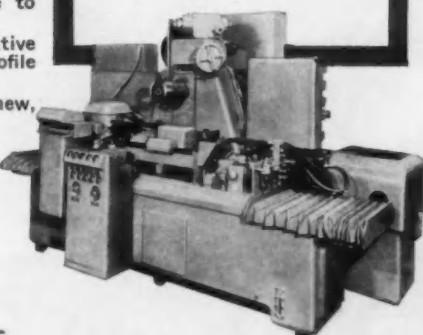
"The new Gear Grind Machines presently used in the aircraft engine division are the first major development in this type of machine since their use at Pratt & Whitney. They were developed in cooperation with Pratt & Whitney engineers to meet the specific and exacting requirements of modern aircraft engine gears. These machines are equipped with a new wheel-trimming feature and a two-speed spindle drive to eliminate burning.

"Another advantage is the relative ease with which the involute profile can be modified."

Write today for Gear Grind's new, comprehensive brochure.

### These Advanced Features Are Also Available:

- Simplified modification of the involute gear tooth profile.
- Automatic trimming of the grinding wheel assures uniformly accurate work.
- Available as fully automatic machines incorporating automatic loading and unloading.



Pratt & Whitney's J-57 Turbojet: The most powerful aircraft production engine in the world is rated in the 10,000-pound thrust class.

### THE GEAR GRINDING MACHINE COMPANY

3903 CHRISTOPHER, DETROIT 11, MICHIGAN

Manufacturers of:

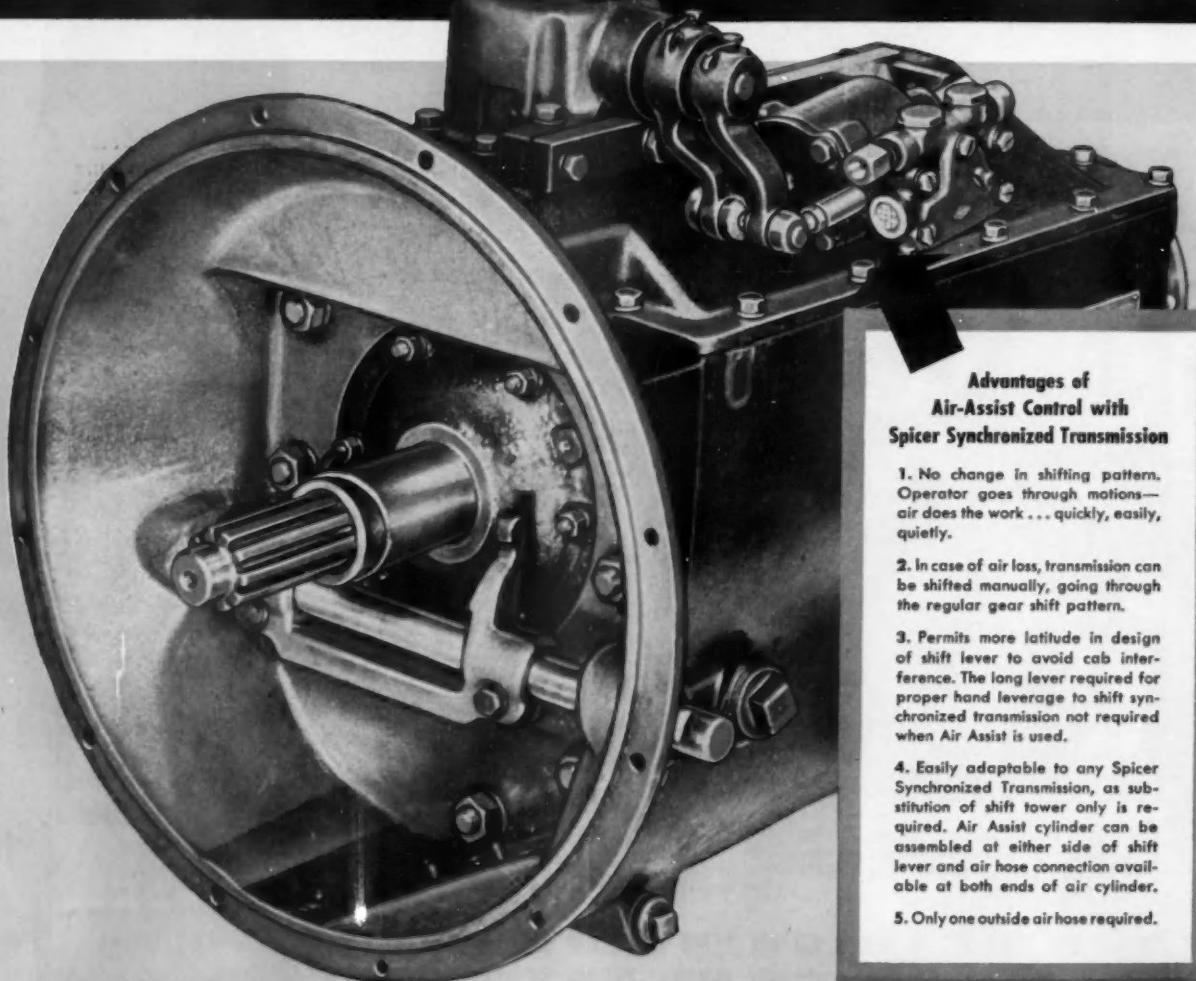
The Detroit Screwmatic 750, Automatic Screw Machine.  
RZEPFA ("Sheppa") Constant Velocity Universal Joints.

56-C

**EASY**  
does it!



**SMOOTHLY**  
does it!



**Advantages of  
Air-Assist Control with  
Spicer Synchronized Transmission**

1. No change in shifting pattern. Operator goes through motions—air does the work . . . quickly, easily, quietly.
2. In case of air loss, transmission can be shifted manually, going through the regular gear shift pattern.
3. Permits more latitude in design of shift lever to avoid cab interference. The long lever required for proper hand leverage to shift synchronized transmission not required when Air Assist is used.
4. Easily adaptable to any Spicer Synchronized Transmission, as substitution of shift tower only is required. Air Assist cylinder can be assembled at either side of shift lever and air hose connection available at both ends of air cylinder.
5. Only one outside air hose required.

**DANA CORPORATION • Toledo 1, Ohio**



**AIR  
DOES IT... in any shift pattern  
under any operating conditions...**

# with the new **Spicer** **AIR ASSIST SHIFT**

Take it easy, man . . . take it easy! Take it easy . . . with the Spicer AIR-ASSIST doing all your endless, tiresome shifting routine!

Air does the heavy work . . . powerful compressed air at your fingertip control. All you do is go through the shifting motions . . . AIR-ASSIST easily, smoothly, quietly guides the gears through the most intricate shifting pattern.

The AIR-ASSIST Shift adds another feature to the long list of advantages already offered by the Spicer Synchronized transmission:

- Equal Shifts for Driver Convenience
- Positive Blocker Type Synchronizers
- More Leverage for Ease in Shifting
- Alloy Steel Carburized Gears
- TOCCO Fork Pads for Long Wear
- Gear Hopping Guards
- Large Bearings for Long Mileage

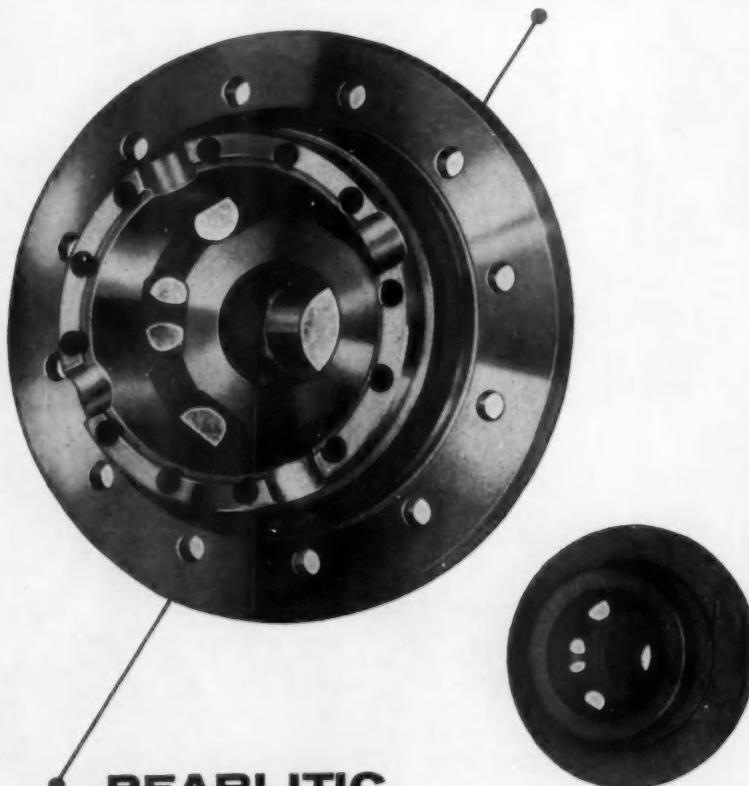
The AIR-ASSIST Shift is available only on Spicer Synchronized Transmissions . . . optional on new equipment, or available as a replacement unit on Spicer Synchronized Transmissions now in use.

Over 250,000 Spicer Synchronized Transmissions have been installed in heavy-duty trucks and busses, for a wide range of civilian and military services. Ask Spicer engineers to help you adapt the Spicer Synchronized Transmission and the new AIR-ASSIST Shift to your needs.



**SPICER PRODUCTS:** TRANSMISSIONS • UNIVERSAL JOINTS • PROPELLER SHAFTS • AXLES • TORQUE CONVERTERS • GEAR BOXES • POWER TAKE-OFFS • POWER TAKE-OFF JOINTS • RAIL CAR DRIVES • RAILWAY GENERATOR DRIVES • STAMPINGS  
SPICER and AUBURN CLUTCHES • PARISH FRAMES • SPICER FRAMES

# MACHINABILITY INDEX 80-90\*



## PEARLITIC MALLEABLE CASTINGS

Low machinability index of 80-90 (B1112 steel = 100) is probably reason enough to warrant serious consideration for your product.

But pearlitic malleable castings—from National—don't stop there. They have great ultimate strength . . . resist wear under heavy loads at high speeds . . . make excellent non-seizing bearings . . . can be air or liquid-quenched . . . can be smooth-finished.

Don't overlook the advantages of pearlitic malleable. For pearlitic malleable castings—from National—can often reduce manufacturing costs, weight and assembly time . . . can increase the sales potential of your product.

AA-1906

## NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Cleveland 6, Ohio

The Nation's largest independent producer of malleable and pearlitic malleable

## Hydrostatic Transmission

(Continued from page 53)

through passages in the casting and the fixed hollow shaft. It is distributed by a simple, pressure-loaded face valve consisting of a stationary disk with recessed arcuate slots. Material is cast iron faced with hard chromium. This presses on a rotating ring with circular holes corresponding to each cylinder inlet channel. Return flow is through an annular passage surrounding the hollow shaft.

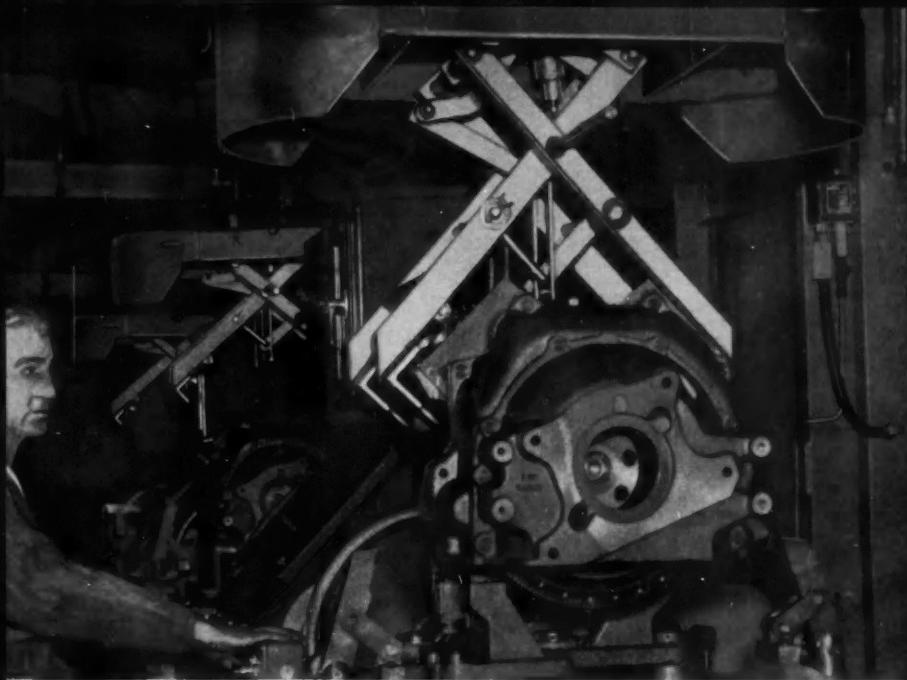
Motors are reversed by changing the direction of flow. They are intended to run with casings full of oil, and excess fluid escapes through a gallery drilled in the eccentric and along the fixed shaft. This construction avoids high-pressure seals exposed to atmosphere, and any leakages result only in an internal loss.

Bore and stroke are 3% in. by 2% in., giving a maximum piston thrust of about 35,000 lb and 2600 psi loading on the sliding pads. The pistons are sealed with two cast iron rings.

The motors are connected in parallel, and differential action between the two wheels is automatic. A slowing down of one wheel causes an increased rate of delivery to the other. This hydrostatic circuit maintains full flow between the pump and motors and back again. All pipes are housed in two tubular frame members.

A supplementary circuit compensates the main hydraulic lines for loss of fluid, and thus prevents the entry of air into the system and the need for bleeding. Oil from a make-up tank, carried by a gear-type boost pump, is introduced into the drive circuit on the inlet side of the piston pump. Since the direction of flow through this pump changes in accordance with the movement of the tractor, a pair of non-return valves in the pipes leading to either end of the pump automatically select the low-pressure side. Excess fluid is piped back to the tank.

Overall motor efficiency is stated to be better than 85 pct at 18 rpm, corresponding to a tractor speed of 3 mph. Speeds can be varied infinitely between zero and about 6 mph, and the single control and absence of separate brakes simplify operation when soil resistance in a given field changes widely. Tests have shown that fuel consumption is only very slightly more than that obtained with a standard Fordson Major. The general design is felt to be well adapted to large tracklayers since steering clutches could be eliminated.



Over 100 pairs of Heppenstall Safe-T-Tongs are carried by a modern power-and-free conveyor on a prominent automobile producer's assembly line. They pick up partially assembled engine blocks and deliver them to machines which drill their crankshaft area. Next, the tongs lift the blocks and transport them to the following operation.

## Heppenstall automatic Safe-T-Tongs, custom built to your individual needs, speed handling, eliminate safety hazards

Heppenstall's fully-automatic Safe-T-Tongs are today's answer to many difficult material handling problems encountered in "automated" production set-ups. Requiring no power, they operate merely by being lowered on the burden to be lifted. They go through their entire cycle of automatic operation quickly, safely, accurately and efficiently.

Safe-T-Tongs are also widely used in the automotive industry where individual lifts of materials are handled by hoist or crane. They do not require any rigging or chains on the load to be lifted, nor ground chainmen — thus eliminating potential safety hazards. Your craneman does the entire job, either from his cab or by remote control.

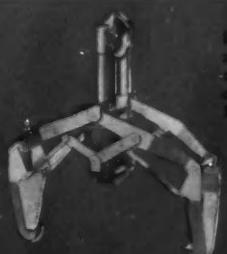
Whatever your particular handling jobs require — regardless of shapes, weights or sizes — Heppenstall tongs, engineered specially to your individual needs, will help you economically speed materials handling operations with greater efficiency and safety.

For complete information and technical assistance contact Heppenstall Company, New Brighton, Pa. Sales offices and representatives are located in principal industrial centers.



# Heppenstall

...tongs for every automotive lifting problem

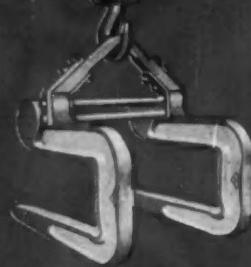


MotORIZED Horizontal Coil Tong

Rack and Pinion Horizontal Coil Tong  
capable of handling  
coil widths from  
19½ to 32 inches



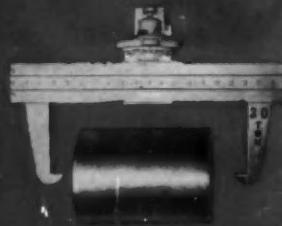
MotORIZED and Manually Operated  
Sheet Lifter



Cast Double "C" Hook



Single "C" Hook



MotORIZED Rotating Horizontal Coil Tong

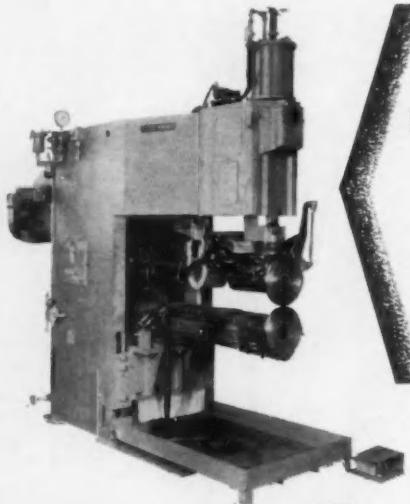


Single Vertical Coil Tong



MotORIZED Rotating Cross Hook



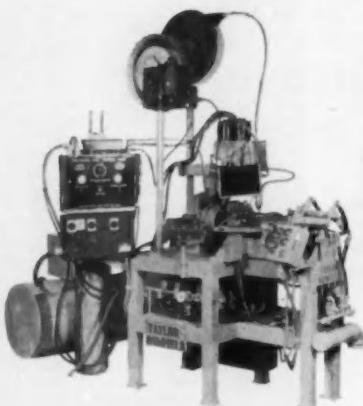
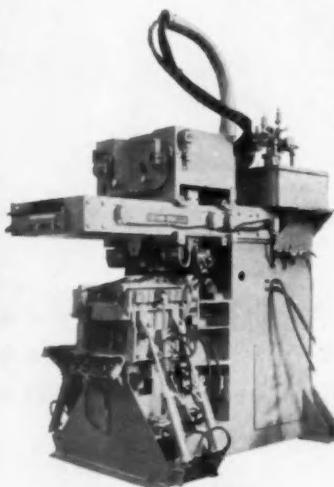


### STANDARD RESISTANCE WELDERS

Efficient, versatile for all basic uses; low operating cost, prompt delivery, long service life. T-W manufactures a complete line of resistance welder equipment—spot, seam, projection and flash-butt.

### SPECIAL RESISTANCE WELDERS

Resistance welders specifically designed for your work—most efficient production, including mechanical features, such as feed, handling, discharge, bending, forming or machining.



### SPECIAL ARC WELDERS

Custom designed for arc-welding assemblies on a production basis. All modern welding methods and equipment are incorporated. T-W are specialists in production line techniques.

*The* **TAYLOR-WINFIELD Corporation**  
WARREN, OHIO



#### ELECTRIC RESISTANCE AND ARC WELDING MACHINES

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DAYTON • DENVER • DETROIT • LOS ANGELES • PHILADELPHIA  
PORTLAND, OREGON • SEATTLE • ST. LOUIS • STAMFORD  
OAKVILLE AND WINDSOR, ONTARIO



(Continued from page 158)

Lockheed Aircraft Corp. has announced that work has begun on a \$19 million expansion project at its California Div. plants. It is part of the company's larger \$92 million long-range growth plan.

H. O. Canfield Co. has developed a new rubber that can withstand extremely low temperatures encountered in high altitude flights.

Lincoln Electric Co. has begun an \$8 million expansion program that will increase its present capacity for manufacturing by 60 per cent.

Gas Appliance Service, Inc., has moved to 1940 Balmoral Ave., Chicago 40, Ill.

Westinghouse Electric Corp. will add a four-story wing to its new Research Laboratories building near Pittsburgh, Pa. . . . Raytheon Manufacturing Co. will erect an engineering laboratory at Goleta, Calif., for the design and development of airborne electronics and infrared equipment.

Walmet Corp. is name of new concern formed in Madison Heights, Mich., to develop and manufacture special grades of cemented carbides.

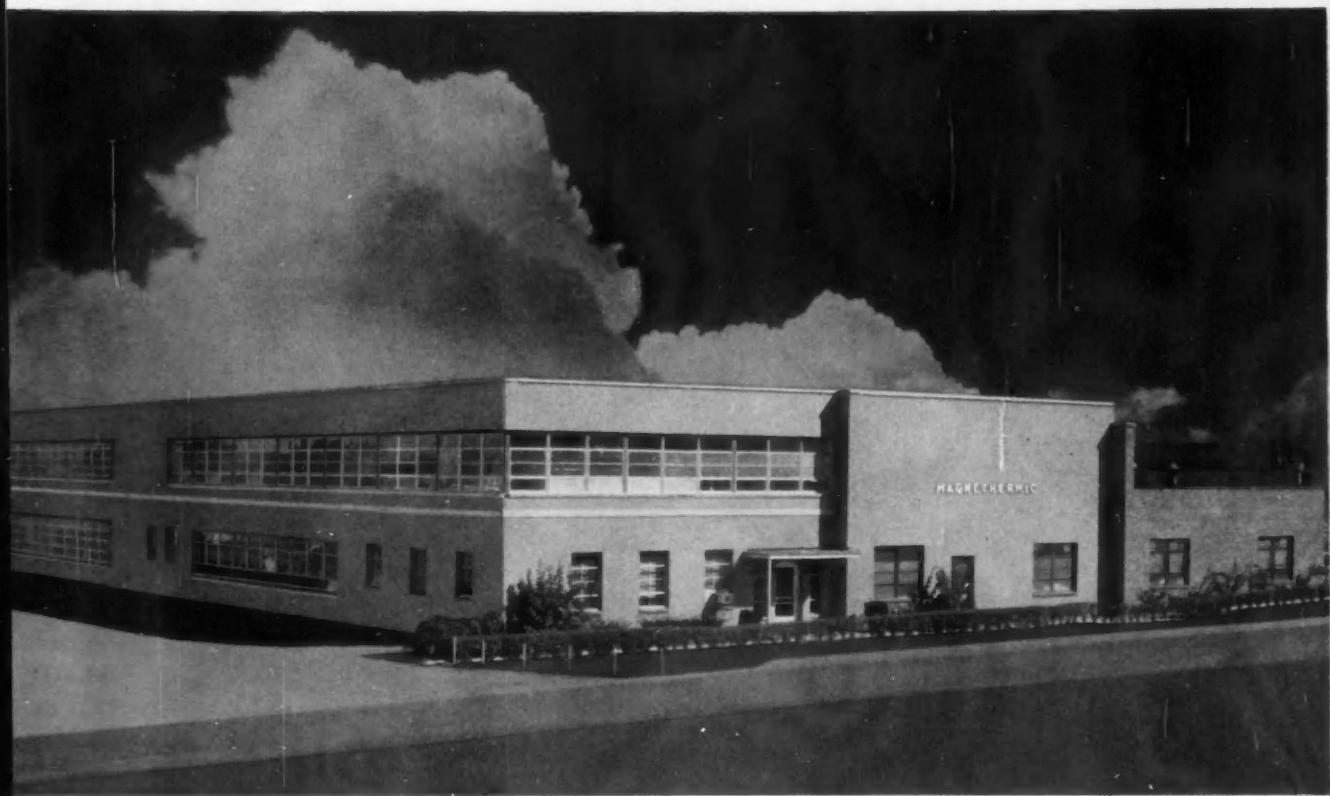
Specialized Trailers, Inc., has been set up at 7400 Laurel Canyon Blvd., North Hollywood, Calif., to design and produce mobile hauling equipment. . . . Penn Keystone Corp. is name of new firm formed in West Conshohocken, Pa., to develop and produce position indicators.

Tube Reducing Corp. has announced the development of a tube forming process to overcome the usual difficulties of cold working the so-called "nuclear metals."

Temco Aircraft Corp. has announced that it will build a \$1 million engineering center adjacent to its Garland plant.

(Turn to page 178, please)

**INDUCTION HEATING IS OUR <sup>ONLY</sup> BUSINESS**



**Only one interest here . . . Your Order For  
INDUCTION HEATING EQUIPMENT**

Is heating or heat-treating involved in your metal-working process?

If so, let a Magnethermic engineer review your operations and show you what induction heating can do for you.

For example, Magnethermic has designed high frequency equipment for continuous localized heat-treating of electric welded pipe. Another Magnethermic installation pre-heats 32" diameter aluminum ingots, weighing 5,000 pounds, prior to extrusion.

Magnethermic's plant at Youngstown houses diversified facilities and specialized personnel devoting full time to induction heating, Low, Dual and High frequency.

Whether your inquiry concerns heat-treating, hot working or joining, Magnethermic can do the job. For specialized, intelligent attention, place your inquiry with the specialist—Magnethermic.





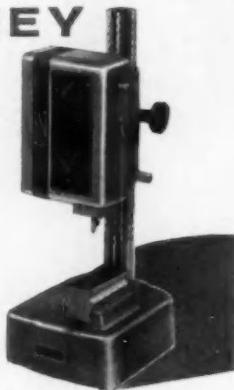
*If*  
**PRODUCT PRECISION  
and QUALITY are  
WEIGHTY PROBLEMS**

... rely on  
**THESE SCALES**

## **PRATT & WHITNEY BENCH COMPARATORS**

### **P & W SIGMATIC COMPARATORS**

Inexpensive high precision. Require no outside power source. Combine the simplicity of mechanical operation with high magnification (to 5000X). Easily portable. For external gaging applications.



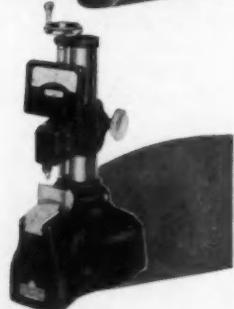
### **P & W AIR-O-LIMIT COMPARATORS**

Extremely versatile — use a large variety of gaging internal and external attachments to check a wide range of products. Readily engineered to meet your special requirements.



### **P & W ELECTROLIMIT COMPARATORS**

Wherever the ultimate in gaging accuracy is required. Combine mechanical gaging with electrical magnification for easy reading of errors in "tenths" or "hundredths." Magnifications to 110,000X.



WRITE NOW FOR DESCRIPTIVE PRODUCT CIRCULARS . . . outlining your Quality Control Requirements.



**PRATT & WHITNEY COMPANY**  
INCORPORATED

18 Charter Oak Boulevard, West Hartford 1, Connecticut  
Branch Offices and Stocks in Principal Cities

MACHINE TOOLS • GAGES • CUTTING TOOLS



(Continued from page 176)

Chevrolet will build a new zone office and warehouse building at Cleveland, O.

Ford Motor Co. has released a sound film called "Thundermakers," depicting the assembly of the J-57 turbojet.

Unisteel Body Co. has announced a new line of aluminum van bodies.

Harvill Corp. is building a new plant at Santa Ana, Calif.

Dow Chemical Co. is marketing a new thermoplastic material called Styrex.

General Electric Co. has realigned its Direct Current Motor and Generator Dept. to include three new product sections.

Warren Mfg. Corp. has been organized in Warren, Pa. for the manufacturer of automotive products.

Mexican import duties on tractors have been reduced by presidential decree.

Alloy Precision Castings Co. has leased a new plant at 3855 West 150th St., Cleveland, O.

Lima Electric Motor Co. has opened a new branch office at 6432 Cass Ave., Detroit 2, Mich. . . . Du Pont Textile Fibers Dept. has opened a rubber industry sales office at 326 South Main St., Akron, O.

Carrier Corp. has developed a new small jet-powered refrigeration unit for use in the air conditioning system of the new Douglas DC-8 jet airliner.

Mexico has authorized the German Krupp interests to build a plant in Irole for the production of light agricultural machinery.

Ramo-Woolridge Corp., Los Angeles, established a research, development, and technical liaison facility in Boston.



## MAGNETO DESIGN SERVICE



**Call on Fairbanks-Morse for help in solving  
your magneto ignition problems!**

**YOU CAN PROFIT** many ways by submitting your magneto ignition problems to Fairbanks-Morse engineers.

First, you get improved product performance because Super-Spark magnetos are tailored to fit your equipment and give you the kind of dependability; easy starting; simple, rugged design; and economical performance you and your customers expect.

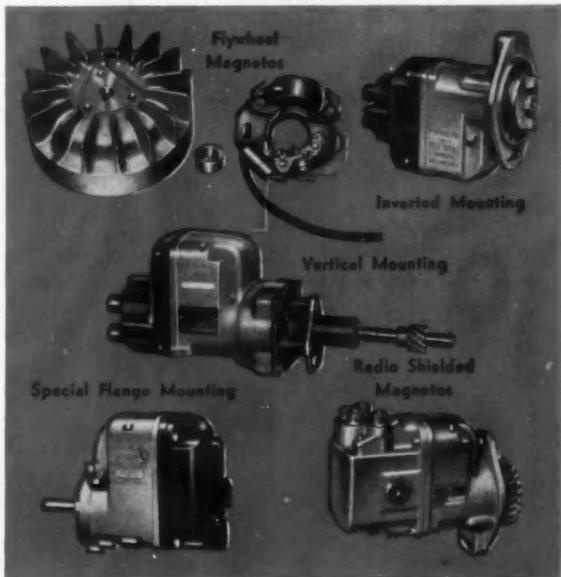
But Fairbanks-Morse offers more than engineering advances and precision manufacturing. The wide selection of more than 400 different magnetos in our line enables us to use standard components, keeping manufacturing costs down and giving you higher quality at a lower price.

Your new product plans are always treated in complete confidence. Only the men working on your project know about it. And... after design and field testing, Fairbanks-Morse is equipped to manufacture and ship in accordance with your schedule requirements.

**Also important to you and your customers . . .** Fairbanks-Morse assumes complete responsibility, from design studies to field service. More than 2,500 authorized service stations throughout America are equipped to handle repairs, replacements, and parts for more than 3,500,000 Super-Spark magnetos now in use.

So, whatever your special requirements may be: radio shielding, fungus protection, special mounting, flywheel application, heavy-duty design, or extra voltage output — call on Fairbanks-Morse for expert engineering and complete follow-through! Write to Fairbanks, Morse & Co., Magneto Division, Beloit, Wisconsin, for Bulletin FM75F.

**MORE THAN 3,500,000  
MAGNETOS IN THE FIELD**



**FAIRBANKS-MORSE**

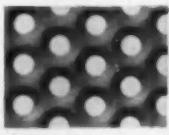
*A name worth remembering when you want the BEST*

MAGNETOS • REWIND STARTERS • WATER SYSTEMS • GENERATING SETS  
PUMPS • MOTORS • SCALES • DIESEL LOCOMOTIVES AND ENGINES

# H & K

## SURFACED PERFORATIONS

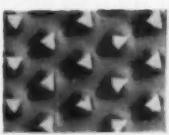
are used in many products



Small Indented Round Holes



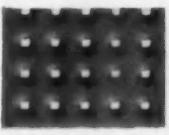
Indented Slots



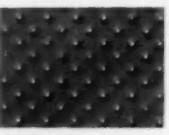
1/16" Triangular Stabbed Holes



Hooked Stabbed Holes



Coarse Surfacing



Fine Surfacing

Illustrated are only a few of the many surfaced perforations for which we have dies. We have thousands of different die patterns to perforate practically any metal in sheets, rolls and coils.

If your product requires surfaced perforated materials, contact either H & K office or one of our agents. We will be glad to work with you on your perforating requirements.

Fill in and mail coupon to office and warehouse nearest you.



Listed Under "Perforated Metals"

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Chicago Office and Warehouse New York Office and Warehouse  
5630 Fillmore Street 106 Liberty Street  
Chicago 44, Ill. New York, N. Y.

Please send me—

- GENERAL CATALOG NO. 62
- STOCK LIST of Perforated Steel Sheets
- SAMPLES of Perforated Plastics and Paper
- PRICE INFORMATION (NOTE: Send specifications of perforated materials wanted, if necessary send drawings or sketches.)

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

## Making Windshield Reveal Moldings

(Continued from page 57)

nickel tank and this results in substantial operational savings. Roughness on plated surfaces is avoided through the use of constant filtration and periodic thorough cleaning of tanks. Total length of the conveyorized tank is 95 ft and motor generators supply 1500 amp per rack. Each rack load presents 6 sq ft of plating surface.

The foregoing plating procedure is that applied to cold rolled steel moldings. Stainless steel moldings are produced, polished and buffed in the same manner but do not require, of course, any copper or nickel plating. They are chrome plated, however, largely because such plating gives them the same color as other chrome plated parts.

Plating of stainless moldings is done on a conveyorized machine of which the loading-unloading station appears in Fig. 8. Processing includes direct and reverse cleaning at 210 F, soak cleaning at 180 F, (Fig. 9), followed by a dilute sulphuric acid etching dip before entering the chrome plating solution, which is held at 125 F. Rinsing is done between tanks. At the end of the line, which is 58½ ft long, there is a dip for reclaiming chrome plating solution, a cold spray rinse and a dip in hot water to promote quick drying. Current of 2000 amp per hanger is applied. Racks are 60 by 34 by 14 in. and each holds parts having 10 sq ft of plating area.

Although the chrome plating is bright, some color buffing of the chrome plate is required and is done along a line part of which appears in Fig. 10. This is chiefly, however, to remove any "burn" marks that may occur. After buffing, moldings are laid on a belt and undergo careful inspection before passing along to a packing department.

Clearly, much care is exercised in all production and finishing operations. In consequence, products of highest quality result.

## AUTOMOTIVE INDUSTRIES . . .

Is your News Magazine of  
Automotive and Aviation

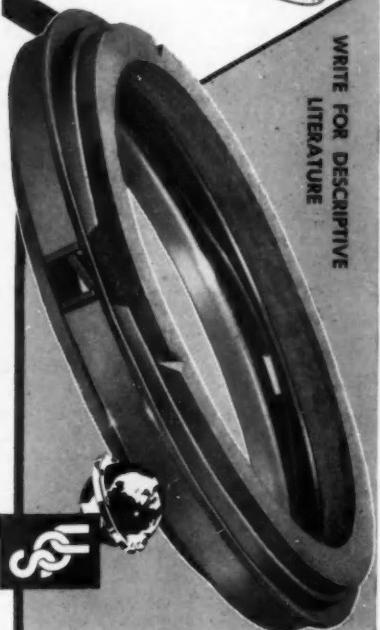
MANUFACTURING

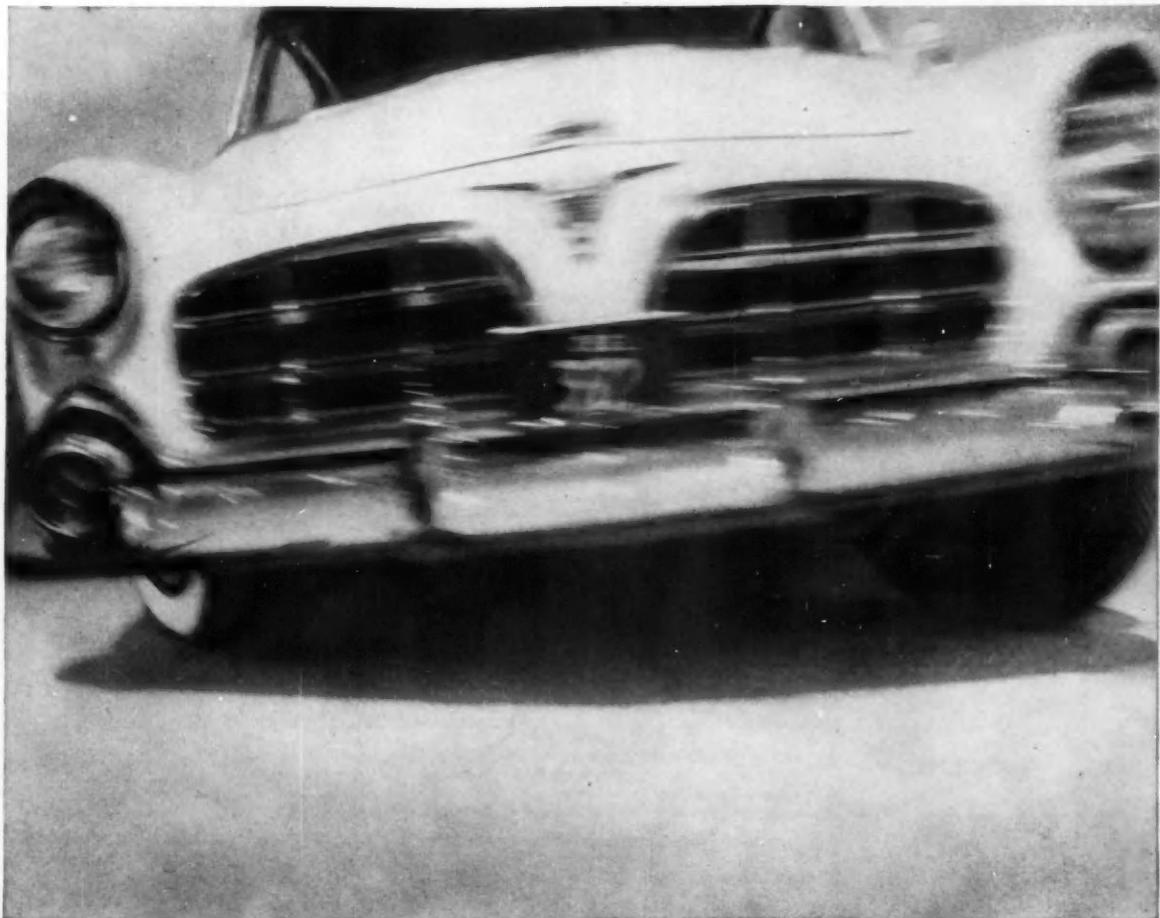
- ## Universal SPECIAL CS SHAFT TYPE OIL SEAL WITH 8 BIG ADVANTAGES
- High speeds improve efficiency.
  - Low friction.
  - Long, trouble-free life.
  - Ideal for high operating temperatures.
  - Permits greater shaft eccentricity.
  - Unaffected by sudden acceleration.
  - No replacement problems.
  - Nominal cost.

UNIVERSAL OIL SEAL CO. P.O. BOX 74 PONTIAC, MICHIGAN



WRITE FOR DESCRIPTIVE  
LITERATURE





Typical tire distortion caused by high-speed turn. Tougher, stronger nylon cord tires resist damage from such everyday punishment.

# THERE'S EXTRA SAFETY IN NYLON CORD TIRES

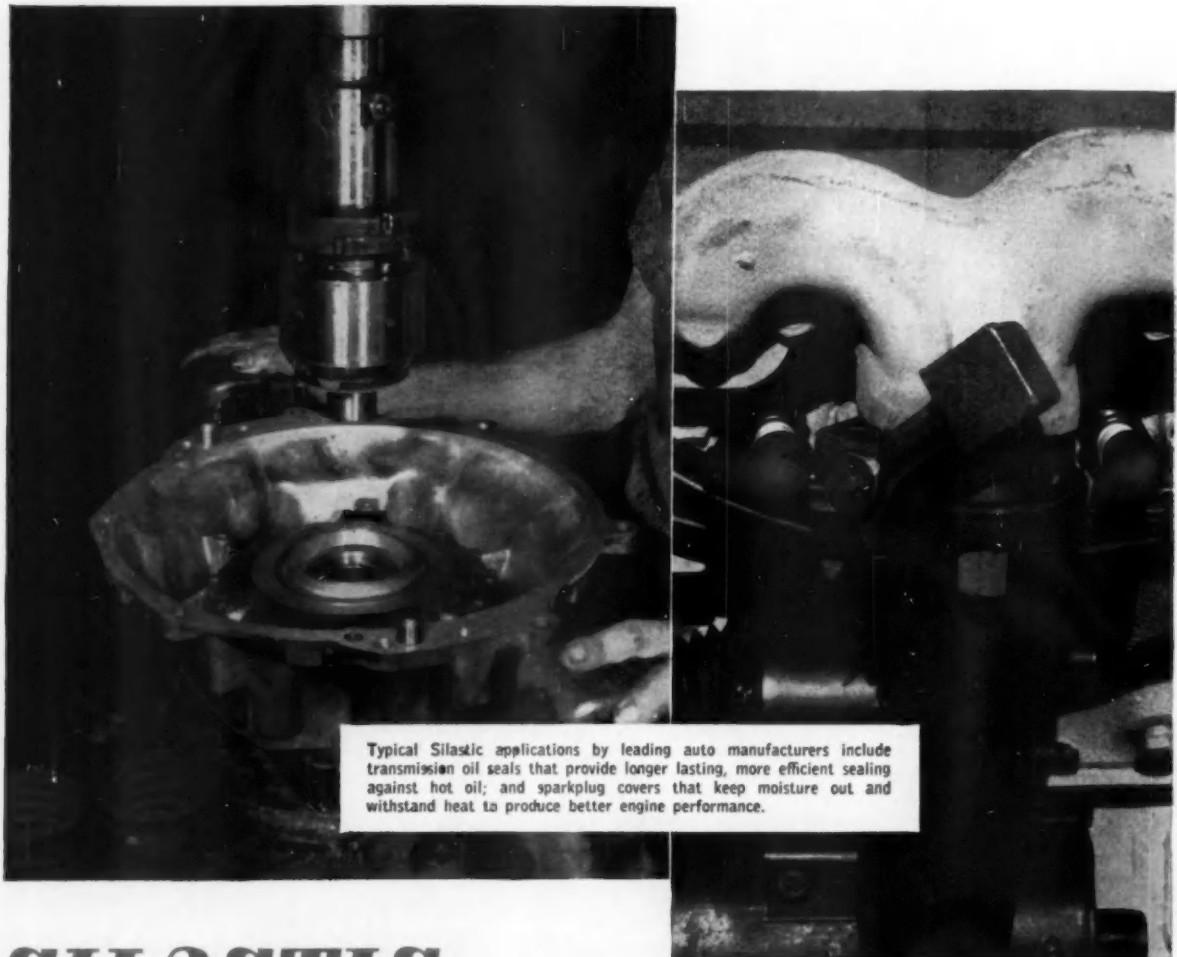
*Du Pont produces the nylon fiber.  
Tire manufacturers make nylon cord tires  
—in tubeless or conventional types.*

Tires are among the components that can help make today's fine cars even safer. For our roads—whether superhighway or city street—are traveled to a point that tire failure of any kind is a potential danger.

- Nylon cord tires offer utmost safety, surest protection against tire trouble. Nylon tires have proved their superiority on military and commercial planes and on heavy-duty trucks. The people whose lives and livelihood depend on the ability of cars to perform at high speeds rely on nylon tires. Turnpike police, professional auto racers and high-speed test drivers are examples.
- Nylon cord tires reduce unsprung weight, and they readily absorb the added strains of power steering, braking, and higher horsepower.
- Nylon cord tires are among the components which contribute importantly to motor-car safety. They are the coming standard of the industry. As original equipment, they provide a valuable sales feature—extra safety.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY





Typical Silastic applications by leading auto manufacturers include transmission oil seals that provide longer lasting, more efficient sealing against hot oil; and sparkplug covers that keep moisture out and withstand heat to produce better engine performance.

# SILASTIC

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Get latest data on Silastic

Mail coupon today

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\*T.M. REG. U.S. PAT. OFF.

Molded parts of Silastic\*, Dow Corning's silicone rubber, show little or no change in physical or dielectric properties after long exposure to temperature extremes which would quickly ruin organic rubber. Leading rubber companies fabricate Silastic molded parts in practically any color, size or shape.

#### Typical Properties of Silastic for Molded Parts

• Temperature Range, °F	-130 to 500
• Tensile strength, psi	600 to 900
• Elongation, %	150 to 300
• Compression set, %, @ 300 F	15 to 40
• Hardness range, durometer	20 to 90
• Dielectric strength, volts/mil	400 to 500
• Oil resistance	Dependent on type of oil

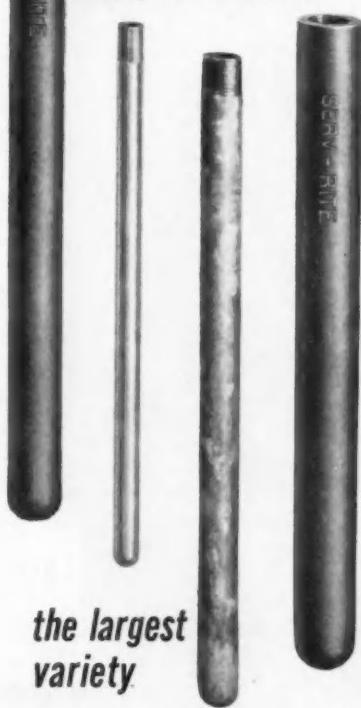
If you consider ALL the properties of a silicone rubber, you'll specify SILASTIC.

first in silicones

DOW CORNING  
SILICONES

DOW CORNING CORPORATION • MIDLAND, MICHIGAN

for any requirement  
in Protecting Tubes  
it's  
**SERV-RITE**



**the largest  
variety**

In size and length, in iron, nickel, and alloys, and in formed or precision drilled, Gordon has about the largest variety of thermocouple protecting tubes. And you get off-the-shelf delivery on most any of this great variety of "standard" tubes. Gordon also makes protecting tubes to specifications for special requirements.

Give Serv-Rite a trial on your next protecting tube requirements. You can't go wrong. Careful manufacture and rigid inspections assure satisfaction. Get full information today. Ask for Bulletin 11-13.

• Bulletin 11-13 gives general application data, specifications, and ordering information on Serv-Rite protecting tubes and protecting wells—the largest grouping in one listing.

6221

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The Soviet Union produced as many Ph.D.'s in 1953 as the U. S. However, U. S. degrees were 2.3 to one in favor of the humanities, while the Soviet degrees ran 3 to 1 in favor of science and engineering.

The engines of a new U. S. jet bomber, flying at only 375 mph, develop more horsepower than 400 automobiles of 200 hp each.

Today, there are nearly 12 million motor vehicles and tractors on U. S. farms, almost twice as many as in 1940. It is estimated that during a 12-month period this equipment generates 10 times as much mechanical power as is used in all American industry.

There are 57 million passenger car drivers in the U. S., and 20 million of them are women.

Some economists have calculated that by 1965 every American will be using about 840 gal of petroleum every year.

The American farmer uses more petroleum power in his tractors, trucks, automobiles, and self-propelled implements than is used by all other industries combined.

American steel workers work far less time to fill a market basket with food than steel workers of other countries. In this country, it requires one hr, 38 min of work, on the average to buy eight staple items. By contrast, the following times are required in these four other countries: United Kingdom, four hr, 45 min; Sweden, five hr, one min; West Germany, six hr, 27 min; France, nine hr, 51 min.

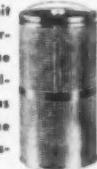
Farm families buy 10 per cent of the new cars sold and six per cent of the used ones.

**THERE'S NO SUBSTITUTE  
for LUBER-FINER'S  
ENGINEERED  
PROTECTION**



**YES! IT'S WHAT'S  
INSIDE  
THAT COUNTS**  
The Efficiency of  
Luber-finer's Exclusive  
Patented Process  
**HAS NEVER  
BEEN EQUALLED!**

**USE ONLY GENUINE**  
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Only a Luber-finer Unit  
Plus a Genuine Luber-  
finer Pack can give the  
Exclusive Patented Fil-  
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Standard of The Indus-  
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**THERE'S A LUBER-FINER MODEL  
FOR EVERY TYPE OF ENGINE—  
EVERY TYPE OF OIL!!**

**LUBER-FINER PACKS  
AVAILABLE**

**1. REFINING PACK**

Introduced to the public in 1935 for use with straight mineral oils, fuel oils, hydraulic oils, and inhibited industrial oils.

**2. DIESELPAK**

First made available in 1941, the DIESELPAK was primarily designed for use with H.D. detergent compounded oils and has also achieved outstanding results when used with fuel oils and straight mineral oils.

**DON'T BE MISLED  
BY PRICE ALONE!**

There is no substitute for DIESELPAK's Patented Filtering Process for H.D. Compounded oils AT ANY PRICE!

The DIESELPAK cleans more oil faster—keeps it CLEAN longer—and gives more service and better engineered protection than ANY of the substitute filtering elements being offered for Luber-finer units.

**IT PAYS TO GET THE BEST!**

**STANDARD OF THE INDUSTRY  
SINCE 1936**

Luber-finer Units are Standard and Optional Equipment on America's Leading Diesel Trucks, Tractors, Stationary Engines. Write for Complete Information to Dept. 45

**LUBER-FINER, INC.**  
2514 S. Grand Ave., Los Angeles 7



**There is NO SUBSTITUTE for a forging:  
NO SUBSTITUTE for  
Wyman-Gordon Experience**

There is more to the superiority of the forged crankshaft than just strength.

No other method of fabrication can compare with the forging process for dependability. The uniformity and predictability of physical properties with minimum variance from piece to piece or from one location to another in the same piece is assured to the greatest degree by modern forging practice.

Top automotive engineers agree that the use of a forged crankshaft permits the design of a more compact engine which is

a decided advantage when thinking in terms of limited space available and overall engine weight reduction.

As compression ratios increase and engine outputs go up the risk factor must be reduced. Again, the uniformity of quality in the backbone of the engine, the crankshaft, is most essential and made possible only by a forging.

There is NO SUBSTITUTE for a forging and in a forging there is NO SUBSTITUTE for WYMAN-GORDON quality and experience.

# **WYMAN-GORDON COMPANY**

*Established 1883*

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**new  
clutch  
is  
adaptable  
to  
all  
torque  
needs**

V

\* By varying the number of springs in multiples of three, *Lipe* can adapt the five sizes of its new Direct Pressure Clutch to all engines developing from 300 to 1300 ft-lb of torque. For example: depending on its service, a 15" DP can be furnished with its full complement of 27 springs . . . or only 24, 21, 18, or 15.

The advantages of this unique *Lipe* feature are obvious. Manufacturers will find it may be possible to standardize on a single clutch size to meet *all* torque requirements. Fleet Owners will notice the significant reductions in maintenance since clutches won't be under- or overloaded.

*Write for full information.*

Manufacturers of Automotive Clutches & Machine Tools



***Lipe* - ROLLWAY**  
CORPORATION  
SYRACUSE I., N.Y.

# CONTINENTAL RED SEAL POWER PROVIDES

# *Air Conditioned Comfort for Travelers*



Time was when bus travel in summertime had little to recommend it, but carriers like Greyhound's Highway Traveler are rapidly changing all that. . . . This luxury coach has six-foot panoramic windows, adjustable reclining chairs, the famous Air Suspension Ride, and most important of all, perhaps, perfected air conditioning by Tropic-Aire. . . . Its Tropic-Aire system, product of McGraw Electric Co., Chicago, operates on dependable Continental Red Seal power. . . . Gasoline Models Y-91 and Z-129, and the latter's ZD-129 Cushioned Power Diesel counterpart are interchangeable in the same compartment, with identical mountings. . . . All three have been engineered expressly for the job.

• • •

## *Continental Motors Corporation*

MUSKEGON • MICHIGAN

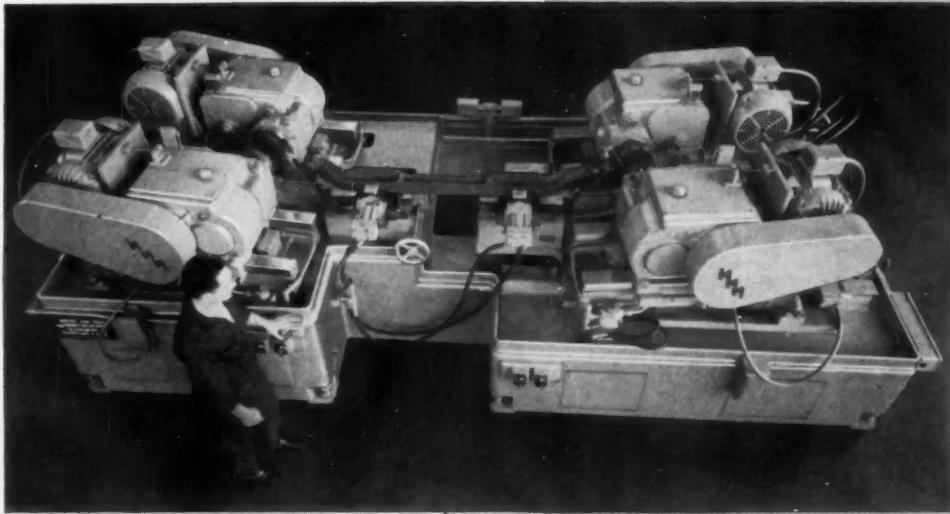


6 EAST 45TH STREET, NEW YORK 17, NEW YORK • 6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 3817 SOUTH SANTA FE AVENUE, LOS ANGELES 58, CALIFORNIA • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GEORGIA

**MIGHTY BIG JOB**

**MINIMIZED by another**

**MOTCH & MERRYWEATHER Production Solution**

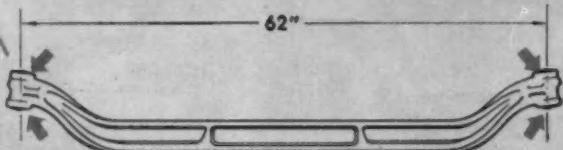


*Traveling head universal double duplex milling machine.*

Four faces of a part are milled simultaneously by this universal-special machine. Mill faster, more accurately, at less cost with a head for each surface. Motch & Merryweather engineers can design universality into special equipment. Thus, machines performing a specific task can be quickly adapted to a variety of sizes. Have M. & M. study your next job with a view to broadening the usefulness of ostensibly special equipment.

*Write for Bulletin S-56 describing  
M. & M. Duplex Milling Machinery.*

**YOU'RE AHEAD  
WITH A HEAD FOR  
EACH SURFACE**



*Operation: Milling kingpin bosses of truck axle.  
Material: . . . . . Forged steel.  
Brinnel Hardness: . . . . . 217-255.  
Machine cycle time: . . . . . 30 seconds*

**THE MOTCH & MERRYWEATHER  
MACHINERY CO.**

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

*Builders of Automatic Precision Cut-off, Milling and Special Machinery*

**Gardner-Denver... Serving the World's Basic Industries**

## Keep production on the up and up

with powerful, lightweight  
**Keller Tool air hoists**

Here's the hoist you can start and stop all day long—without any danger of a burned-out motor to halt production. It's powered by a Keller Tool axial piston air motor that just won't burn out.

Keller Tool air hoists offer other advantages as well, including easily controlled speed—fast for the high lift—creep for accurate load spotting.

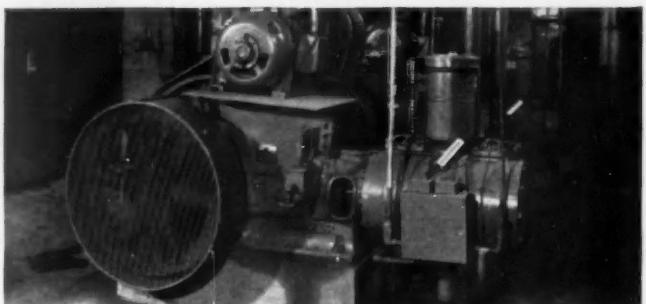
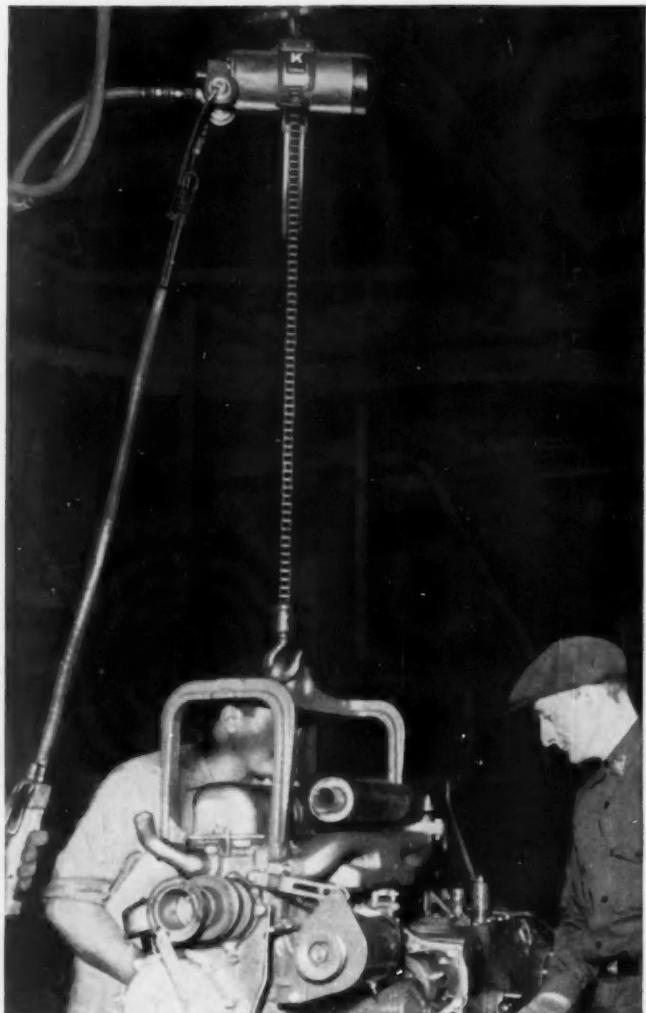
When you need a lift in a dusty room or in a corrosive atmosphere, a Keller hoist will handle the job without unusual maintenance. The enclosed air motor is made for such locations.

Every Keller Tool air hoist is light in weight in relation to its lifting capacity. Simplifies moving and hanging. All sizes furnished with roller chain; some sizes also available with link chain. Check the capacity you need in the table below:

Model	Capacity	Speed	Weight
86-1V3	300 lb.	80 f.p.m.	28 lb.
86-1V5A	500 lb.	35 f.p.m.	28 lb.
86-1V10*	1000 lb.	19 f.p.m.	28 lb.
86-2V10	1000 lb.	35 f.p.m.	78 lb.
86-2V20*	2000 lb.	19 f.p.m.	78 lb.

\*Available with link or roller chain

Send today for Bulletin 86.



A popular unit in the compressor room: the Gardner-Denver RX. Capacities from 90 to 1300 cfm. Described in Bulletin HAC-40.

# GARDNER - DENVER

**KELLER TOOL** division, Grand Haven, Michigan

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS  
FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY



# A Formsprag Clutch can simplify the functioning of your design

Designers are constantly finding ways to simplify the design of their products by utilizing Formsprag's higher torque capacity and precision. Over-running, indexing, and backstopping applications are almost unlimited.

The modern, patented design of Formsprag Clutches is the secret. Each clutch—designed with utmost simplicity—offers the highest possible torque capacity in an extremely small area. And, you get rugged, precision performance with long life.

The next time you're thinking of maximum clutch efficiency for your product—remember these principles about Formsprag Clutches:

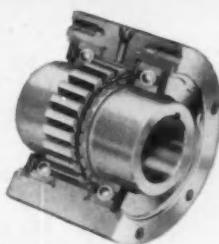


William T. Cherry, Mgr., Formsprag Application Engineering Dept.

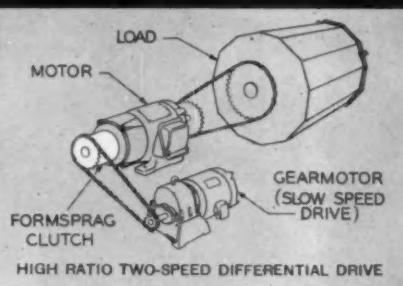
## How Formsprag's simple, precision design works for you



Sprags used in Formsprag Clutches are highly developed, precision wedges of hardened alloy steel. Due to the sprag's design, an unusually high amount of torque is delivered from one concentric race to the other. When torque is applied, the sprags are instantaneously engaged. When torque is removed, the sprags release instantaneously.



Basic construction of the Formsprag Clutch is simple. A full complement of sprags is inserted between inner and outer concentric races. Contact with both race surfaces is maintained by energizing springs. Formsprag construction allows more sprags to be inserted in a smaller area than other clutch designs. Result: greater torque capacity in a smaller clutch.



Here is a typical over-running arrangement on a two-speed drive: The clutch transmits power during the low speed cycle while the high speed motor acts as a countershaft and transmits power to the load. During the high speed cycle, the over-running clutch permits the low speed motor to be over-run. This arrangement is particularly economical and efficient where the speed differential required is too great for a two-speed motor.



Formsprag's engineering department has solved literally thousands of clutch application problems—using either standard or specially designed clutches. For further information, send for this informative eight-page brochure or contact Formsprag direct.

A7-7B

World's Largest Exclusive Manufacturers of Over-Running Clutches

Distributors in Principal Cities

**FORMSPRAG**  
Company

23583 Hoover Road, Van Dyke, Michigan



# KING-SEELEY

## Automotive Instrumentation



Capably Engineered  
Distinctively Styled  
Quality Controlled



KING-SEELEY CORPORATION  
ANN ARBOR, MICHIGAN

## TWO READY-TO-RUN COMPRESSORS FOR

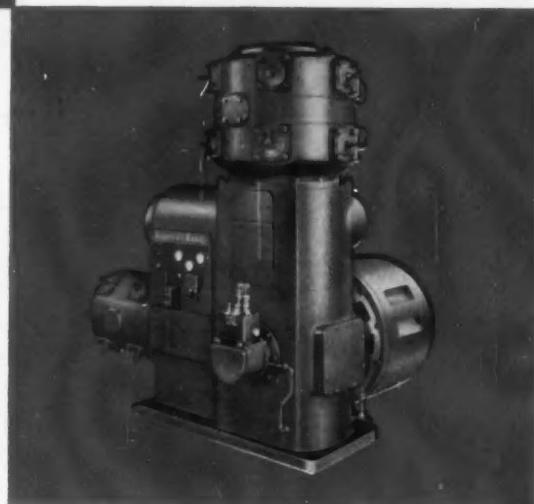


**the PHE**

- 75 and 100 hp packaged
- Opposed-piston balanced design

## LOW-COST AIR POWER

IN YOUR SHOP



*Why MODERN I-R DESIGN can reduce your air power costs and increase your production*

**Built tough for continuous full load**, and refined for efficient performance at all loads.

**Packaged, ready to run**, each unit completely self-contained with crankshaft-mounted motor. Units up to 250 hp are shipped fully assembled, ready to hook up.

**Full-floating aluminum bearings** are foolproof, never need adjustment. They "roll with the punch" of every compressor stroke. Wear is distributed evenly around both inside and outside.

**Closed crankcase** never has to be opened for bearing adjustment, so dirt (the major cause of wear) is kept out of the oil.

**Two-stage, intercooled compression**, with I-R cylinders of proven design, makes most efficient use of horsepower.

**Exceptionally smooth running balance** permits small, simple foundation.

**the XLE**

- 125 to 250 hp packaged
- 300 and 350 hp with engine-type synchronous motor
- Thru-frame air flow

**Compactness** permits installation in small areas, requiring less of your valuable shop space.

**CHANNEL VALVES** give quiet, trouble-free operation and amazing long life due to air-cushioned action and reversible seat plates. Known all over the world for their efficiency, these valves are entirely different in design and principle from any other valve ever used. Channel valves are available only in I-R compressors.



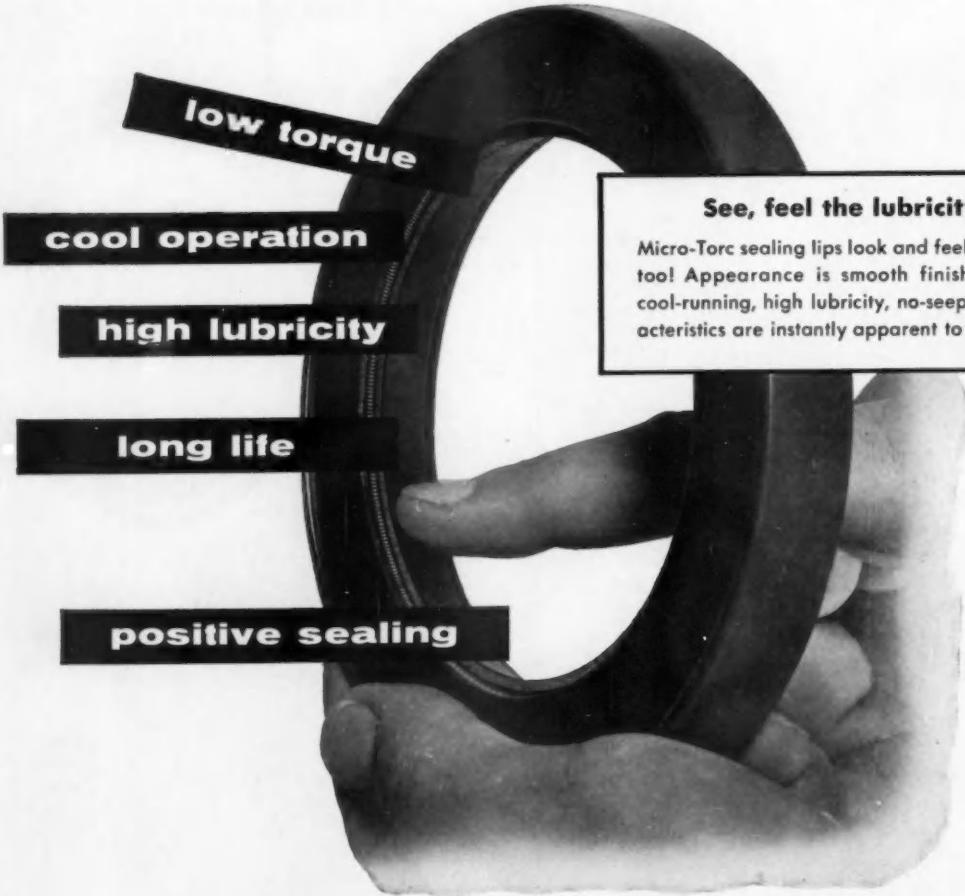
# Ingersoll-Rand

1-381

11 Broadway New York 4, N. Y.



COMPRESSORS • CONDENSERS • AIR AND ELECTRIC TOOLS • TURBO-BLOWERS • PUMPS • ROCK DRILLS • GAS AND DIESEL ENGINES



### **cool operation**

### **high lubricity**

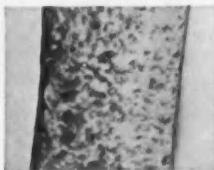
**long life**

### **positive sealing**

**See, feel the lubricity!**

**Micro-Torc sealing lips look and feel different, too! Appearance is smooth finished; their cool-running, high lubricity, no-seepage characteristics are instantly apparent to the touch!**

# **NATIONAL MICRO-TORC<sup>\*</sup> LEATHER OIL SEALS**



**How Micro-Torx works—**Side of chrome retanned leather lip is coated with dry lubricant and elastomer. Elastomer binds lubricant to leather, prevents seepage through leather, enhances mechanical stability—yet permits leather's natural porosity to remain in body of sealing lip. Lip actually stores oil for dry or emergency running!

For applications where temperatures are within  $-50^{\circ}$  to  $200^{\circ}$  F, and shaft speeds are not over 2000 rpm with runout .015 or better, new National Micro-Torc oil seals should definitely be investigated.

The Micro-Torc sealing member is perhaps the most interesting advance in leather oil seals in 15 years. In hundreds of thousands of hours of actual application, Micro-Torc seals have consistently shown up to 80% less torque and 10 times the life of other leather seals. Breakaway torque is normally only 20% of conventional leather seals, and Micro-Torc seals have operated up to 100 hours dry at 1,350 rpm without sloughing or squealing. Properly used, Micro-Torc seals provide positive sealing throughout service life.

Get complete details. Call nearest NMB Engineer, or write for Bulletin.

Engineering help in your plant and ours. NMB'S Application Engineering Service is fast, expert, convenient. Yours for the asking:

CHICAGO, ILL. . . . . Room 462 McCormick Building, HArrison 7-5163  
 CLEVELAND, OHIO . . . . . 210 Heights Rockefeller Bldg., YEllowstone 2-2720  
 DALLAS, TEXAS . . . . . 2520 West Mockingbird Lane, Dixon 7541  
 DETROIT, MICH. . . . . 13836 Puritan Avenue, VErmont 6-1909  
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 INDIANAPOLIS, INDIANA . . . . . 2802 North Delaware Street, WAlnut 3-1535  
 KANSAS CITY, MO. . . . . 4445 Terrace, LOGan 6622  
 MILWAUKEE, WIS. . . . . 647 West Virginia Street, BROADway 1-3234  
 NEWARK, N. J. . . . . 1180 Raymond Blvd., Mitchel 2-7581  
 REDWOOD CITY, CALIF. . . . . Broadway and National, EMERSON 6-3861  
 WICHITA, KANSAS . . . . . 519 South Broadway, AMherst 2-6971

NATIONAL MOTOR BEARING CO., INC.

**Plants at Van Wert, Ohio, Redwood City, Downey and Long Beach, Calif.**

**General Offices: Redwood City**



**Product of the world's largest exclusive manufacturer of oil seals**



**For top performance  
and long service**

**this rugged Tractor relies on machine parts of  
SHELBY SEAMLESS TUBING**

In this powerful Oliver OC-12 Bulldozer, the following parts are fabricated from Shelby Seamless Mechanical Tubing — track shoe rollers, front wheel spring plunger tubes, and the track frame shaft housing. The chief qualifications possessed by these parts are high strength and superior wearability . . . qualities that are just right for a heavy-duty tractor application.

Super-rugged equipment calls for super-strong materials. That's why you'll find USS Shelby Seamless Mechanical Tubing being used for so many tractor applications. Its great strength, complete uniformity, and extreme dimensional accuracy make Shelby Seamless the ideal mechanical tubing for the fabrication of machine parts subject to bruising performance and long wear.

Available in a wide range of diameters, wall thicknesses, various shapes and steel analyses, Shelby Seamless Mechanical Tubing is produced to exacting standards by the world's largest manufacturer of tubular steel products. Contact our engineers for recommendations. They will welcome the opportunity to help you apply Shelby Seamless to your specifications.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.  
(Tubing Specialties)

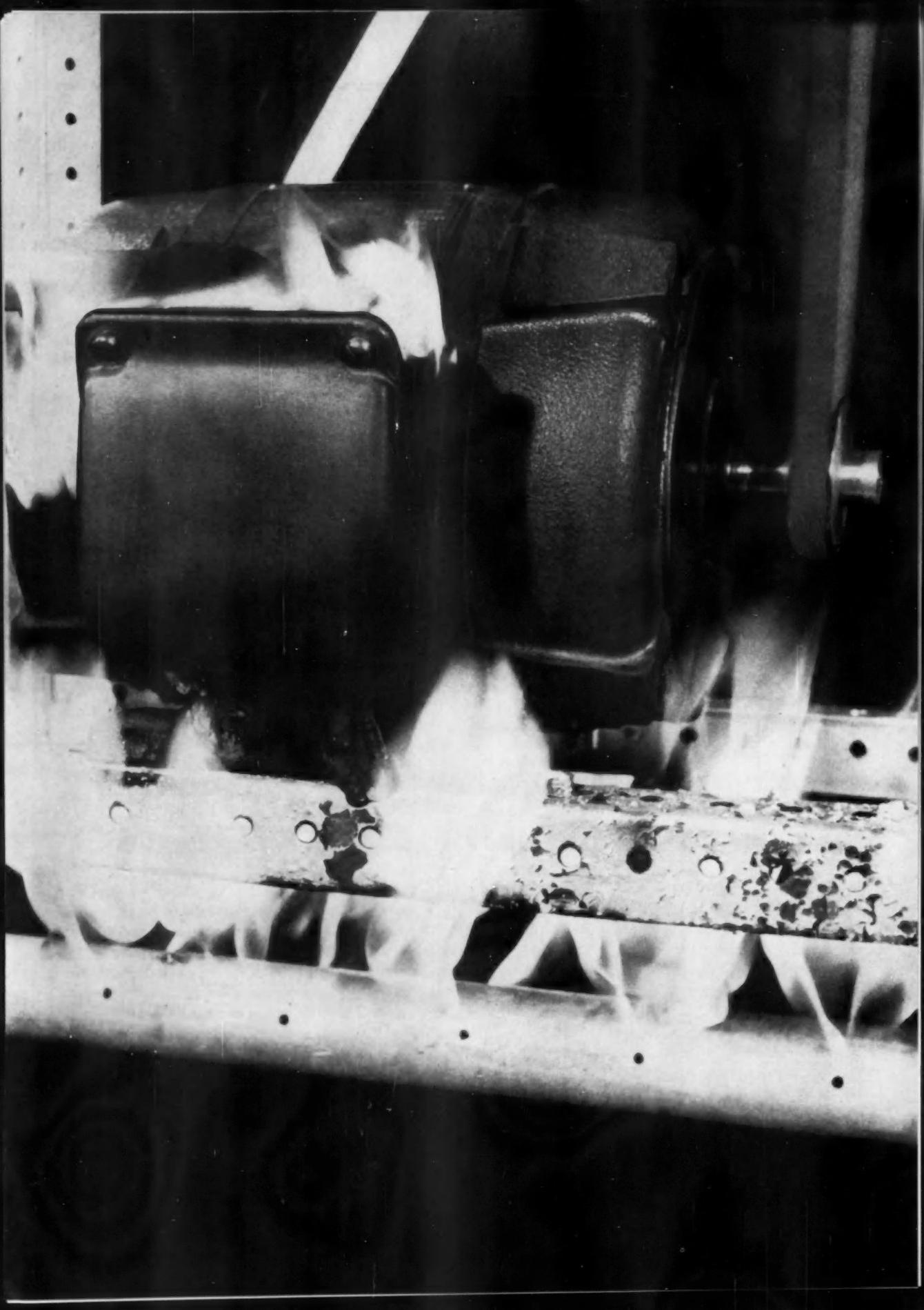
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK



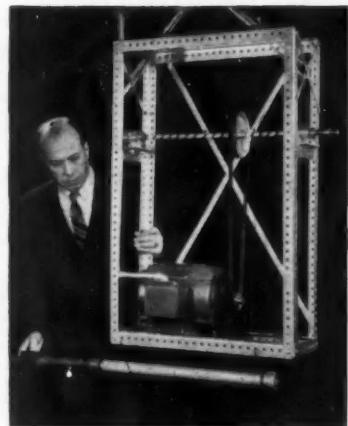
**SHELBY SEAMLESS MECHANICAL TUBING**



UNITED STATES STEEL



TOMORROW:



## A standard motor that can survive infinite heat

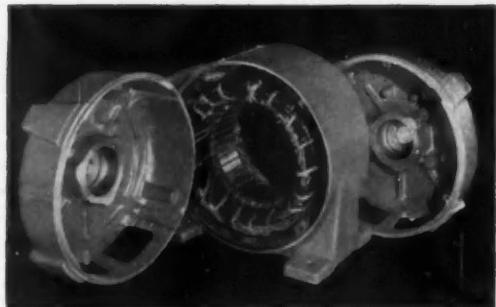
The new *Life-Line A* is another step closer

Westinghouse is working on tomorrow's motor today. Investigating new materials—testing existing motor designs.

No standard motor today can survive the ultimate test shown here. But we do know that the new Life-Line® "A" can operate under higher temperatures than ever before. It has stronger insulation and better bearing protection than any other motor on the market. It's industry's closest approach to a standard motor that is absolutely heatproof.

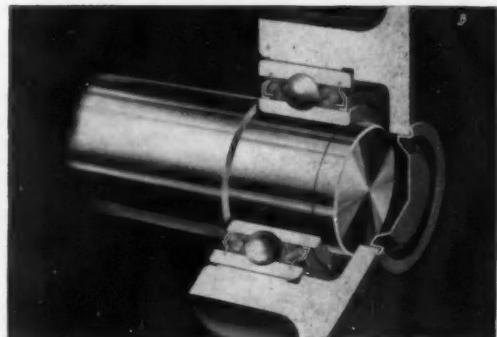
Your Westinghouse sales engineer can show you many additional reasons why the Life-Line "A" is industry's most advanced and preferred motor. Call him today.

J-21926



New fortified insulation includes exclusive Bondar, Bondite and Mylar\*—three good reasons why the Life-Line "A" is so resistant to heat or any other motor contamination.

\*DuPont Registered Trade-Mark



Two outer seals of new 4-way sealed bearing act as flingers and literally throw off damaging contaminations. Inner seals, attached to outer bearing race, are stationary and form a positive labyrinth.

**WATCH  
WESTINGHOUSE!**

WHERE BIG THINGS ARE HAPPENING TODAY!

# New **GLOBE** dry-charged puts battery sales in high gear



**SALES STIMULATING . . . EFFICIENT . . . ALL-IN-ONE PACKAGING** promotes displays, simplifies stocking. Everything needed — battery, electrolyte and pouring holder — is contained in this single, compact package.



**SAFE AND ECONOMICAL TO SHIP AND HANDLE.** Safe sturdy plastic bottle has great resistance to shock or impact. Cardboard bottle holder assures positive grip. **Economical** — 15 plastic bottles weigh less than one glass bottle, cost less to ship, take less time to handle. Disposable bottles eliminate returns. No money tied up in returnable or carboy inventory.

## Get Fast, Low-Cost Delivery, Too!

Thirteen of Globe's 16 battery plants,\* below, are equipped for dry-charged battery and Spinning Power electrolyte production. Their strategic locations put approximately 40% of the automotive market within a 50¢ per cwt truck load freight zone. For all your battery and electrolyte needs, call on Globe to be sure of top-notch sales and performance.

# GLOBE-UNION INC.

MILWAUKEE 1, WISCONSIN

Battery plants at: \*HOUSTON, TEXAS \*MEMPHIS, TENNESSEE \*ATLANTA, GEORGIA \*DALLAS, TEXAS \*MEDFORD, MASSACHUSETTS \*MILWAUKEE, WISCONSIN \*MINERAL RIDGE, OHIO \*PHILADELPHIA, PENNSYLVANIA \*EMPIORIA, KANSAS \*REIDSVILLE, N. CAROLINA \*SAN JOSE, CALIFORNIA \*LOUISVILLE, KENTUCKY \*HASTINGS-ON-HUDSON, NEW YORK—LOS ANGELES, CALIFORNIA—OREGON CITY, OREGON—AJAX, (ONTARIO) CANADA

If it's Petroleum-powered there's a **GLOBE-BUILT BATTERY** right from the start!



**NOW YOU CAN CARRY A COMPLETE INVENTORY**, meet the needs of any vehicle on the road. There's no standing loss or need for annoying trickle charge. Globe dry-charged batteries protect your investment because they're fresh until sold.



**FOR ADDED CONVENIENCE WITH LARGER-SIZED BATTERIES** and to comply with ICC regulations, certain batteries and electrolyte are shipped in separate cartons. Spinning Power electrolyte is packaged in plastic bottles offering the same benefits as those shown previously. Exact specific gravity and acid purity are assured through Globe's quality controls.

*See what adhesives are doing today!*



*The ribbon you see helps make this trailer home snug and weatherproof. It's an adhesive 3M Ribbon Sealer.*

## Fighting weather with a ribbon

Sealing weather out of trailer homes used to be a problem. Water sometimes leaked through seams, spoiling interiors, wetting insulation, corroding metal. But today this manufacturer seals all exterior lap seams with an adhesive 3M Ribbon Sealer. Since using EC 1202 he has had *no leaks* in exterior seams. This 3M product fights weather right to a standstill.

Workers easily roll this flexible, synthetic rubber ribbon along the edge of one aluminum sheet before screwing down the next. Fabric-reinforced EC-1202 is tough. It neither stretches, shrinks nor deteriorates, even during 140°F. paint drying. In fact, EC-1202 adheres so tightly it helps hold the metal together. The result—a uniform, economical, durable seal that shuts

out water, dust and moisture for keeps. Whether you face a specific problem or a general need, call upon 3M research and development. Consult your nearest 3M Field Engineer—or for literature and further information write to 3M, Dept. 317, 417 Piquette, Detroit 2, Michigan.

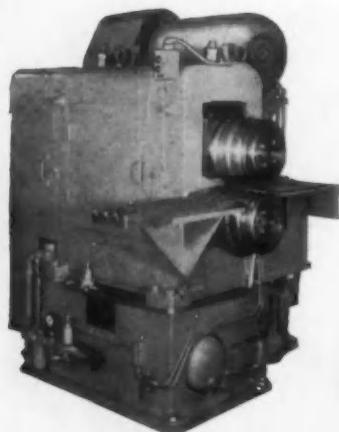
*See what adhesives can do for you!*

PRODUCT OF  
**3M**  
RESEARCH



ADHESIVES AND COATINGS DIVISION, MINNESOTA MINING AND MANUFACTURING COMPANY

417 PIQUETTE AVE., DETROIT 2, MICH. • GENERAL SALES OFFICES: ST. PAUL 6, MINN. • EXPORT: 99 PARK AVE., N. Y. 18, N. Y. • CANADA: P. O. BOX 757, LONDON, ONT.  
MAKERS OF "SCOTCH" BRAND PRESSURE-SENSITIVE TAPES • "SCOTCH" BRAND SOUND-RECORDING TAPE • "SCOTCHLITE" BRAND REFLECTIVE  
SHEETINGS • "3M" ABRASIVE PAPER AND CLOTH • "3M" ADHESIVES AND COATINGS • "3M" ROOFING GRANULES • "3M" CHEMICALS



*from the forging roll . . .*



## AJAX WIDE ADJUSTMENT FORGING ROLLS

PRE-ROLL YOUR FORGING BLANKS . . .

FOR METAL SAVING • LONGER DIE LIFE • BETTER FIBRE FLOW

AJAX ROLLS are built in seven sizes to pre-roll forging blanks ranging from Connecting Rod blanks to the largest Airplane Propellers. Illustrations show Automobile Connecting Rod blank formed (above) and press-forged (below) on AJAX HIGH SPEED FORGING PRESS.

*. . . to the forging press*



WRITE FOR BULLETIN 91-B

THE

**Ajax**

MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND 17, OHIO

110 S. DEARBORN ST., CHICAGO 3, ILLINOIS

W. P. WOOLDRIDGE CO. • BURLINGAME, CAL. • LOS ANGELES 22, CAL.



## JACK COLE cuts trip time 20%

*...with FULLER Semi-automatic  
ROADRANGER® Transmissions*

It's now 24 hours instead of 30 from Birmingham to New York and 26 instead of 32 hours from Birmingham to Philadelphia. Jack Cole Company's new fleet of 43 GMC 860 diesel tractors equipped with Fuller 10-speed semi-automatic R-96 ROADRANGER Transmissions have cut 6 hours off each trip.

Says Jack Cole, President of Jack Cole Company, Birmingham, Alabama: "Our Fleet Supervisor, O. B. Johns, Jr., insisted on the ROADRANGER Transmission for the new tractor to get the ability needed for faster trip time."

Fuller ROADRANGERS provide extra ability with:

- Easier, quicker shifts—10 forward speeds with short 28% steps between ratios
- One shift lever that controls all 10 forward speeds
- No gear splitting — 10 selective gear ratios evenly and progressively spaced
- Higher average road speeds — engines operate in peak hp range with greater fuel economy

- Less driver fatigue— $\frac{1}{3}$  less shifting
- Range shifts pre-selected — automatic and synchronized
- Space-and-weight-saving economies — the most compact 10-speed transmission available
- Transmission weight under the cab—permitting more cargo to be carried on the payload axles

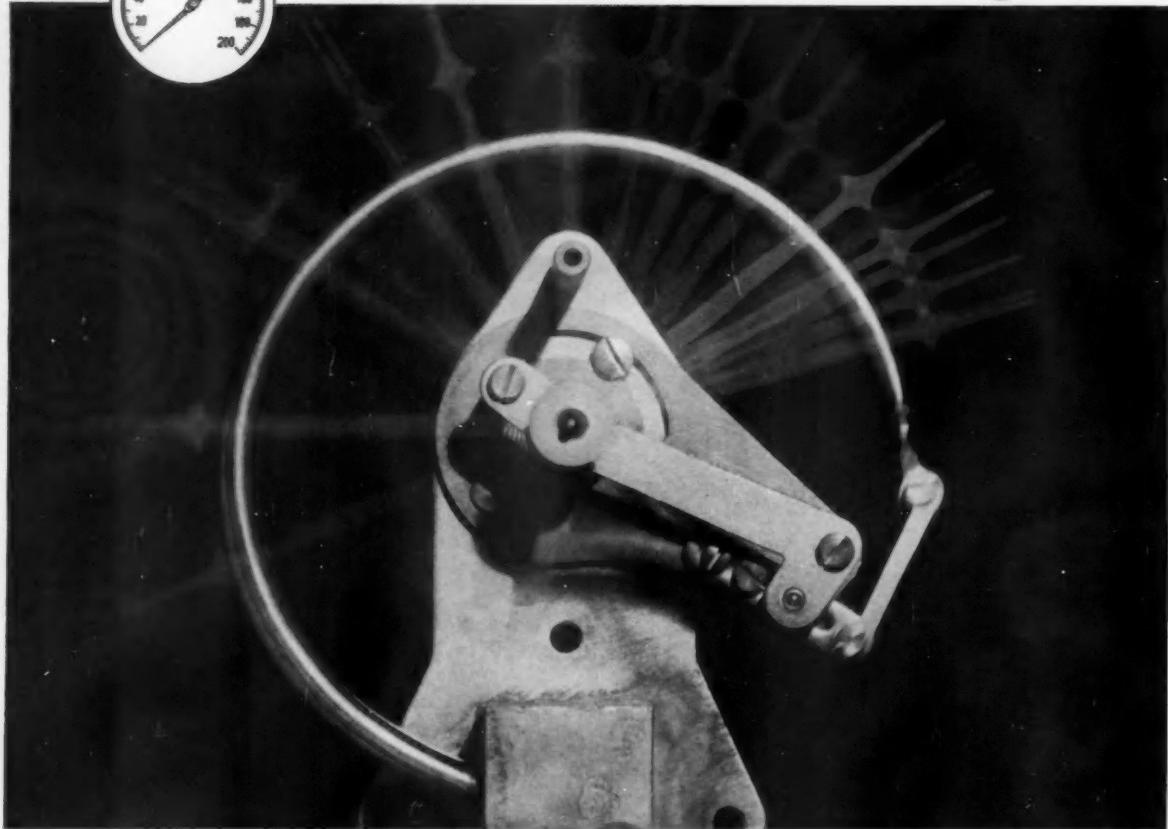
To shorten trip time—to cut maintenance costs—to give your drivers complete control of every driving condition, specify Fuller semi-automatic ROADRANGER Transmissions.



FULLER MANUFACTURING COMPANY  
TRANSMISSION DIVISION • KALAMAZOO, MICH.



# Non-Habit-Forming



Pressure gage courtesy J. E. Lonergan Co., Philadelphia 6, Pa.

## Beryllium Copper Tubing by Superior

This unusual term describes perfectly one of the most important properties of beryllium copper tubing. The Bourdon tube shown above is an excellent example. Once the beryllium copper tube is in the gage, it "remembers" its job and acquires no new habits. It yields constantly to pressure and as constantly returns to its original position without taking a new "set."

Beryllium copper tubing by Superior has this and many other important characteristics to a marked degree, such as hardenability, corrosion and fatigue resistance, thermal and electrical conductivity. It is easy to fabricate, it is nonmagnetic.

Beryllium copper tubing lends itself to a wide variety of applications. It can be severely worked to form convoluted flexible waveguides and bellows. Cold drawn to specifications, followed by proper hardening, it

makes an excellent aircraft antenna, with the strength to withstand thousands of hours' vibrating in 100 mph winds. Used as a contact roll in a business machine collator, it is wear and corrosion-resistant, and a good electrical conductor. Or, as above, shaped for use as a Bourdon tube, it is tough, ductile, durable—and holds its original shape.

Superior produces tubing in over 63 analyses . . . in stainless, alloy and carbon steels, nickel and nickel alloys, beryllium copper, titanium and zirconium. Let Superior's tubemanship and experience help you solve your tubing problems. You'll like the service and the products—they are habit-forming. Send for your free copy of Data Memorandum No. 7 on beryllium copper tubing. Write Superior Tube Company, 2020 Germantown Ave., Norristown, Pa.

# Superior Tube

The big name in small tubing  
NORRISTOWN, PA.

All analyses .010 in. to  $\frac{1}{8}$  in. OD—certain analyses in light walls up to  $2\frac{1}{2}$  in. OD

West Coast: Pacific Tube Company • 5710 Smithway St., Los Angeles 22, Calif. • RAYmond 3-1331

*Fosbond zinc-phosphating Process  
made EVEN BETTER with new, improved*

# actidip

- Gives you one-coat painting
- Lowers effective phosphate weight as much as 70%
- Reduces maintenance cost by cutting down sludge
- Gives more and better surface activation at reduced cost

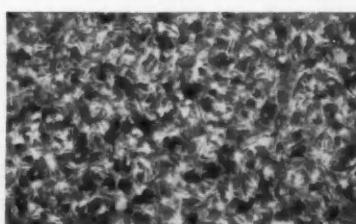
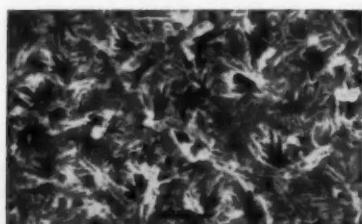
Painted metal surfaces (on automobile bodies, home appliances, and other products) enjoy greatest corrosion-resistance when protected beforehand with Pennsalt Fosbond® coatings. Now, a pre-Fosbond bath with ACTIDIP® brings about even greater crystal refinement, prevents powdering, allows finishing with a single coat of paint. New, improved ACTIDIP, used as a pre-rinse, reduces subsequent zinc phosphate coating weights up to 70% over those coatings applied without surface treatment. As an ingredient in Pennsalt Activated Cleaners, ACTIDIP activates during the pre-cleaning cycle and reduces zinc phosphate coating weights by as much as half.

With recent improvements in formulation, ACTIDIP makes your job easier, boosts your coating quality: (1) Free-flowing and non-caking, new ACTIDIP dissolves more easily, speeds tank charging; (2) ACTIDIP has greater stability, will not lose its superior activating power at higher cleaning temperatures; (3) ACTIDIP, alone or in a Pennsalt Activated Cleaner, reduces sludge and maintenance costs in the phosphating bath.

**Two convenient forms.** New, improved ACTIDIP comes to you in a choice of two forms: (1) Super ACTIDIP Powder for use in its own activating bath between cleaning and phosphating; (2)

Pennsalt Activated Alkaline Cleaners for soak or spray cycles—cleaning and activation in one bath. Either form you choose gives your organic finish a better start towards corrosion-resistance, long-lived luster, and lower cost.

**Find out why** Pennsalt's Fosbond Process means the best in phosphate coatings, and how ACTIDIP can bring you better finishing at lower costs. Ask your Pennsalt man or write Metal Processing Dept. 277, Pennsylvania Salt Manufacturing Company, East: Three Penn Center Plaza, Philadelphia 2, Pa.; West: 2020 Milvia Street, Berkeley 4, Calif. In Canada: Pennsalt Chemicals of Canada, Hamilton, Ontario.



**Sensational reduction in phosphate-coating weight** is shown by these photomicrographs (enlarged 84 times). Untreated panel (left) requires 1006 mg./sq. ft. for adequate phosphate protection, while ACTIDIP-treated panel (right) requires only 277 mg./sq. ft. for effective coverage.



Metal Cleaners • Phosphate Coatings • Cold-Working Lubricants

A BETTER START FOR YOUR FINISH

# MORE EFFICIENT DESIGN, IMPORTANT SAVINGS, SIMPLIFIED ASSEMBLY, BETTER APPEARANCE

These are some of the many benefits reported by Design Engineers who have adopted TRU-LAY PUSH-PULLS for remote control operations on literally hundreds of products

**Here are typical comments** recently received from equipment manufacturers whose machines or implements are equipped with these accurate and dependable remote controls:

#### Saves Time, Labor and Material

"The use of your flexible Push-Pulls saves us a great deal of time, labor and material. The old linkages frequently required much planning in both engineering and shop which is not required now. On some of our equipment we use Push-Pulls from 10 to 30 feet in length. They operate clutch controls on the Main Power Unit, Feed Conveyors and Delivery Conveyors."

#### Greater Flexibility of Design

"The principal advantage of Tru-Lay Push-Pulls in our application is that they permit flexibility in locating the control valve in relation to the operator's position."

#### Cost Less to Install

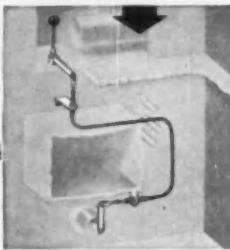
"Tru-Lay Push-Pulls are easier and less expensive to install than linkages for remote control of power take-off,

**TRU-LAY PUSH-PULLS** are "Solid as a rod but Flexible as a wire rope." This flexibility makes it possible to snake around obstructions . . . permits the ideal arrangement of all elements of remote controls.

**Advantages of Tru-Lay Push-Pull flexibility and simplicity are pictured below—**

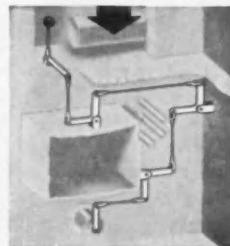
#### TRU-LAY PUSH-PULL

Simple  
One Moving Part  
Life-Time Service  
Life-Time Accuracy  
Low over-all Cost  
Noiseless



#### MECHANICAL LINKAGES

Complex  
Many Parts  
Many Points of Wear  
Increasing Back-Lash  
Loss of Accuracy  
Vibration  
Rattles



**Construction Equipment and Farm Implements** provide good examples of the wide-spread use of these accurate, simple and dependable Push-Pulls. On Power Shovels, Winches, Graders, Road Oilers, Dump Trucks, Snow Plows, Engine-driven Pumps, Crushers, Tractors, Combines, Corn Pickers, Corn Row Sprayers, Corn Detasslers, Orchard Sprayers, Power-driven Tree Trimmers, Tobacco Picking Machines and others . . .

TRU-LAY PUSH-PULLS are operating unfailingly for the remote control of Hydraulic and Air Valves, Brakes, Clutches, Transmissions, Throttles, Chokes, Governors, Power Take-Offs, Spray Nozzles, Vent Directional Fins and on many other applications.

**ACCO**

Our DATA FILE will answer all further questions



AUTOMOTIVE and AIRCRAFT DIVISION  
AMERICAN CHAIN & CABLE

601H Stephenson Bldg., Detroit 2  
2216H South Garfield Ave., Los Angeles 22 • 929H Connecticut Ave., Bridgeport 2, Conn.

## There is No Worry about Failures or Maintenance Costs with TRU-LAY Push-Pull Remote Controls

**Long Life** is a matter of record. We have never heard of a Tru-Lay Flexible Push-Pull Control wearing out in normal service. Failures, that sometimes harass users of more complex controls, are eliminated by the use of these simple, positive-action controls.

**Dependable Operation** of these controls is a certainty, even under the most adverse conditions . . . HOT as jet engines (note: Tru-Lay Push-Pulls are actually performing on hot jet applications) . . . COLD to 70° F below zero . . . SOAKIN' WET . . . ABRASIVE . . . or just plain TOUGH.

**Freedom from Trouble** is assured because of such features as . . . full protection of the inner, working member by the tough flexible conduit . . . lubrication of the inner, working member for life during assembly . . . seals that keep moisture, dust and other foreign matter out of the unit . . . cold swaging of fittings that makes them integral parts of the control unit.

**Accuracy** is inherent in the basic design of Tru-Lay Push-Pulls. They are precision products, not gadgets.

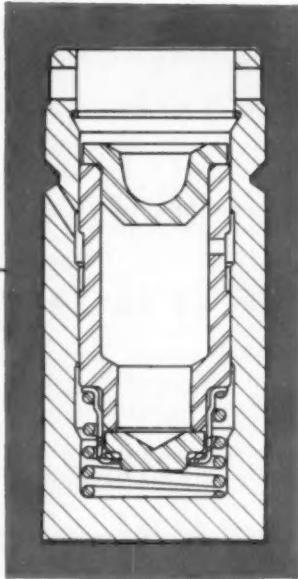
**Capacity** ranges from light jobs up to jobs of 1,000 lbs. input. These Push-Pulls will handle jobs 150 feet or more from the control point.

**"Solid as a rod, Flexible as a wire rope"** aptly describes Tru-Lay Push-Pull Controls. This flexibility provides positive, remote action whether anchorages are fixed or movable . . . it dampens out noise and vibration . . . it greatly simplifies installation of controls by reducing the number of working parts and by making it possible to snake around obstructions.

**Adaptability** to all sorts of mechanical situations explains, in large measure, the wide-spread application of Tru-Lay Push-Pulls. Standard anchorages, fittings and heads have been designed that meet requirements on approximately 80% of the installations. Simple modifications of these standards, or minor changes in your own design, cover almost every special situation. Our engineers have the know-how on such matters, and will work with you.



**For Further Information** — The DATA FILE pictured at the left contains six booklets and bulletins that will answer any further questions you may have about this versatile and dependable tool. It is quite likely that this material will point the way to a simplified solution of your remote control design problems. Write for a copy.



CHICAGO SPRING-LOADED FLAT  
VALVE HYDRAULIC TAPPET

## Designing valve gear?

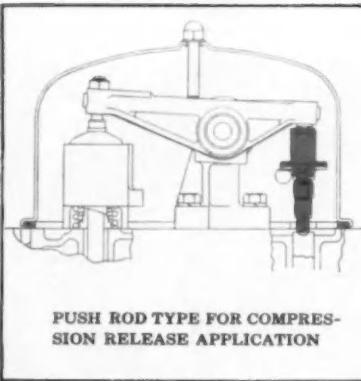
We invite you to use these  
specialized **CHICAGO** services



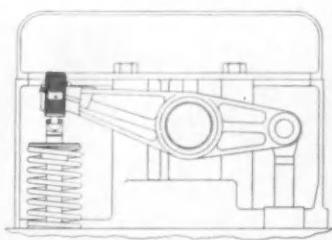
INSERT TYPE ROCKER  
ARM UNIT

### Design

of complete valve gear installations for any type of engine . . . passenger car, truck, tractor, diesel, aircraft or industrial.



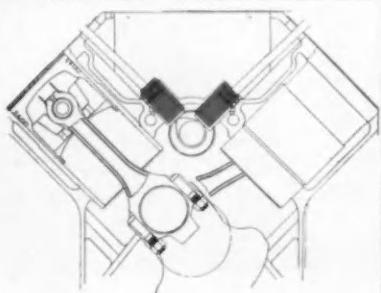
PUSH ROD TYPE FOR COMPRES-  
SION RELEASE APPLICATION



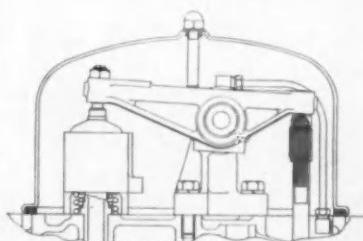
THREADED TYPE ROCKER  
ARM UNIT

### Development engineering

based on years of specialized experience in valve gear problems. The skills of our engineers will prove a valuable addition to your own engineering staff.



V-8 AUTOMOTIVE HYDRAULIC  
TAPPET APPLICATION



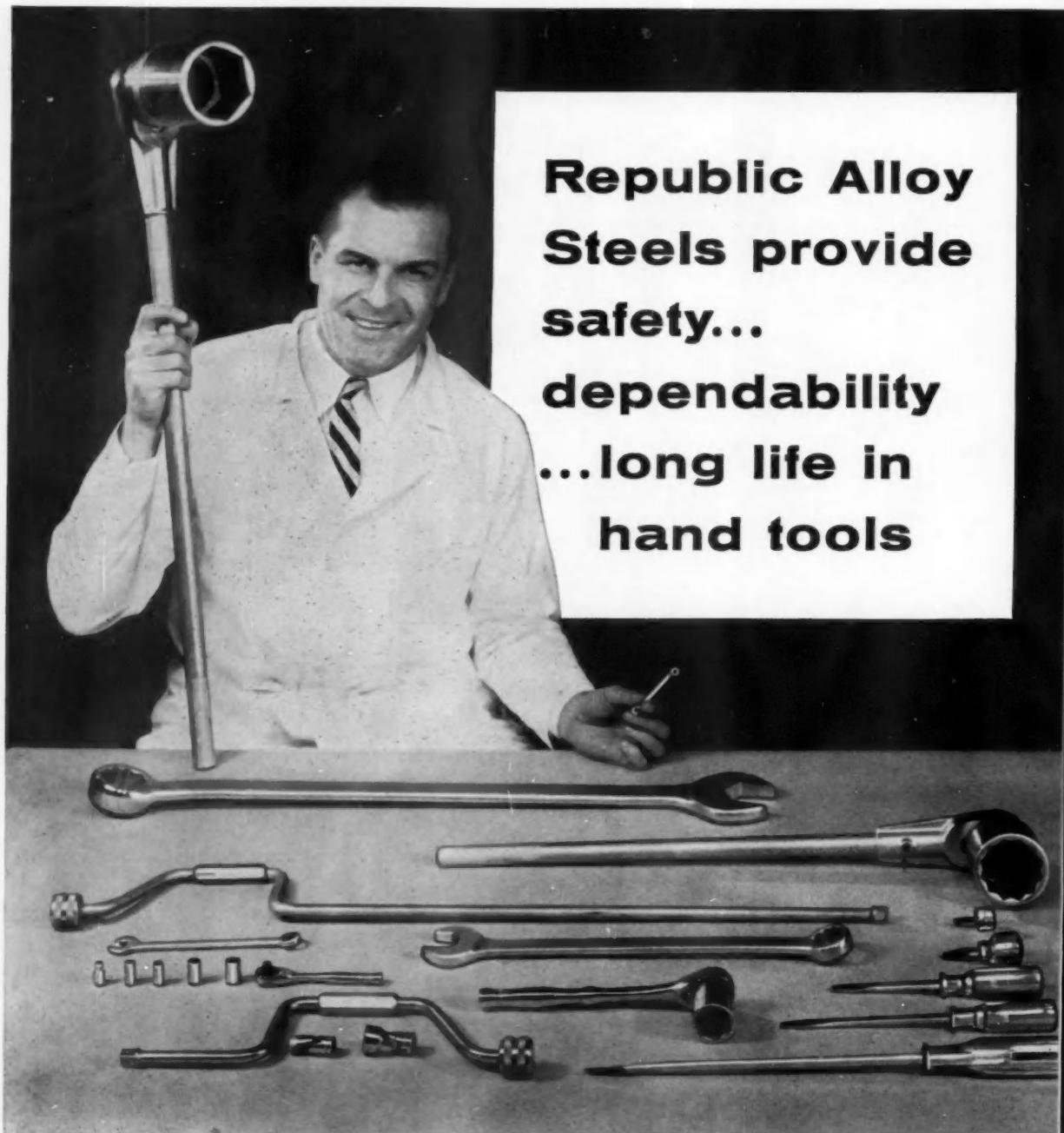
HYDRAULIC UNIT ON  
END OF PUSH ROD

### Tappet manufacturing

CHICAGO's facilities insure precision-manufacturing, scientific testing and rugged, trouble-free performance in every tappet. We will welcome the opportunity to serve you.

# CHICAGO

THE CHICAGO SCREW COMPANY  
Division of Standard Screw Company  
2801 Washington Blvd., Bellwood, Ill.  
*Established 1872*



**Republic Alloy  
Steels provide  
safety...  
dependability  
...long life in  
hand tools**

# REPUBLIC



*World's Widest Range of Standard Steels*

To maintain today's peak production schedules, workmen's hand tools used for assembly, maintenance or repair of equipment must be of high quality. They must be safe and dependable to meet the increased emphasis on the elimination of lost time accidents. They must have long life because production shops keep accurate records on the hourly life of these tools and insist on the ones that last the longest.

Republic Alloy Steels provide tool manufacturers with a combination of qualities essential in the production of socket wrenches, box and open end wrenches, speed handles and screw drivers.

Alloy steels offer a greater degree of safety than other materials because they can be tempered to a greater depth. They can also be heat treated at higher temperatures. Their response to heat treatment is such that uniform structures can be formed in tools where the section mass changes abruptly, as in box wrenches. Higher draw temperatures and greater depth of penetration make a tool that is tougher, able to stand up in severe service.

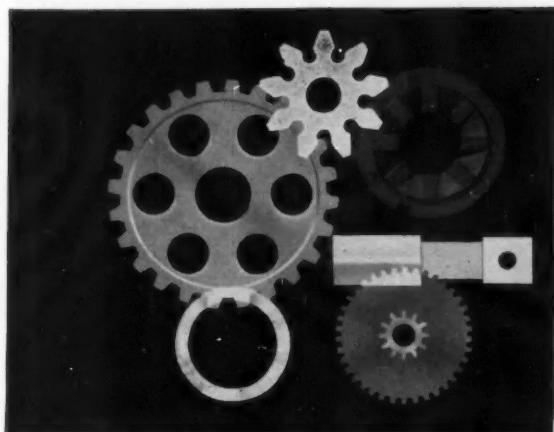
One additional requirement of the modern hand tool is that it be strong, yet easy to handle. Here again alloy steels fit the bill. Their high strength-to-weight ratio permits the use of thinner sections to hold down size and save weight — without any sacrifice of needed strength.

Now, what about your product? Republic metallurgists and engineers are ready to give you obligation-free assistance in the application of these fine steels to your product—assistance that can insure safety, extend equipment life, reduce maintenance and replacement costs. Mail the coupon today.

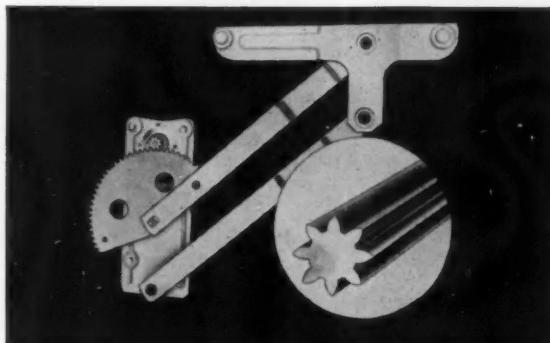
The tools shown at left were made from Republic 4140 Hot Rolled Alloy Steel Bars by The Cornwell Quality Tools Company, Mogadore, Ohio. This manufacturer has used alloy steels for more than 30 years.

# STEEL

*and Steel Products*



**REPUBLIC IRON POWDER OFFERS YOU NEW PROFIT OPPORTUNITIES IN SMALL PARTS PRODUCTION.** Parts can often be made faster, more uniform and at less cost using Republic Iron Powder. It is also being used successfully in making complicated shapes which are difficult to produce economically by other means. Republic metallurgists and engineers, with a thorough knowledge of all types of metals, can help you determine iron powder's suitability to your parts production. Or, they can suggest alternate methods or materials better suited to your particular needs. This service is available without cost or obligation. Just mail the coupon.



**REPUBLIC COLD DRAWN SPECIAL SECTIONS REDUCE MACHINING ON WINDOW GEAR TO TWO SIMPLE OPERATIONS.** The only machining operations required are cutting-off and drilling. The manufacturer uses Republic Cold Drawn Special Sections preformed to the predominating cross section of the gear. Special sections provide almost limitless flexibility in design. They permit replacement of costly assemblies with one-piece shapes. They simplify built-up, interlocking or associated parts. Higher strength, greater hardness and a bright, smooth finish are additional benefits of the cold drawing process. Republic Special Sections are made to specification in all grades of carbon, alloy and stainless steel.

**REPUBLIC STEEL CORPORATION**

Dept. C-2146  
3106 East 45th Street  
Cleveland 27, Ohio

Send more information on:

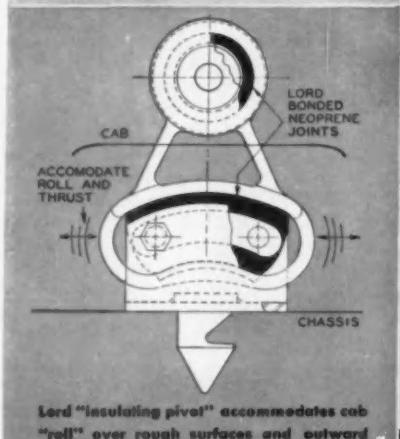
- Alloy Steels       Iron Powder  
 Have a metallurgist call.       Special Sections

Name \_\_\_\_\_ Title \_\_\_\_\_

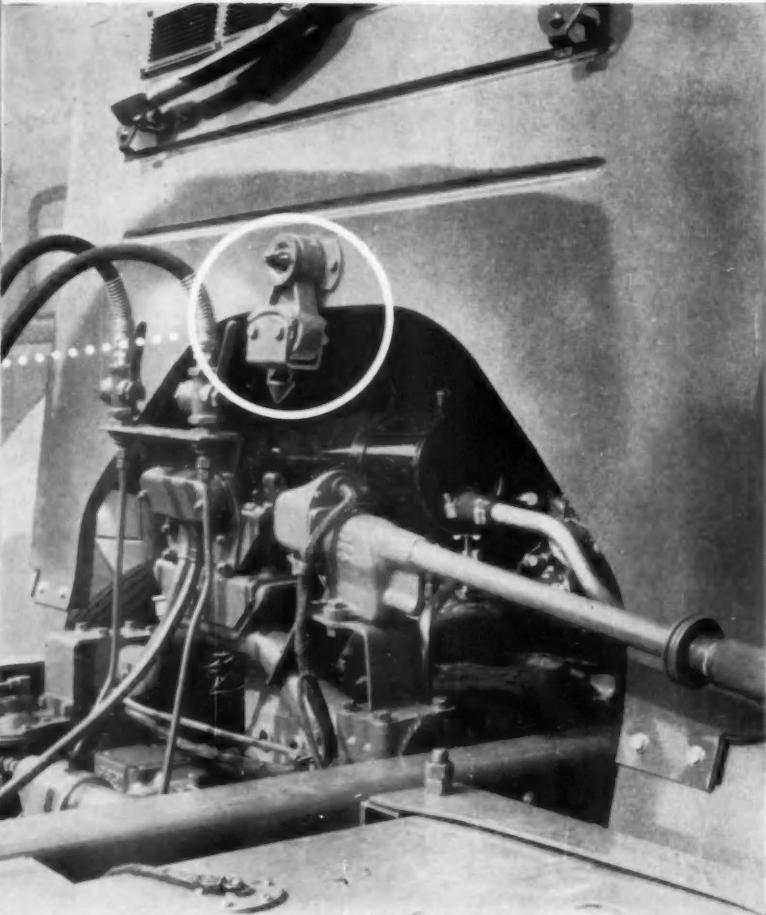
Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



Lord "insulating pivot" accommodates cab "roll" over rough surfaces and outward thrust on curves and absorbs normal road shock and vibration.



## LORD "insulating pivot" contributes to smooth ride of WHITE tilt cab

The unique power-lift cab feature of White 3000 Series Trucks required a connecting device to anchor the rear of the cab to the vehicle frame. Such a device must combine high strength with resiliency to provide smooth, noiseless riding.

White called on LORD Vibration Control Engineers to tackle the problem. LORD's solution was an "insulating pivot"—a rugged bonded rubber mounting which absorbs road noise and cab motion—and requires no maintenance.

As a result, White has used these LORD mountings for four years as standard equipment without a single failure reported. This LORD Mounting replaced an all-metal sliding link which was subject to excessive rattling, costly maintenance and frictional wear.

Wherever noise and vibration are a problem, LORD will design the most efficient solution as a service to you. For further information, call your nearest LORD Field Engineer or the Home Office, Erie, Pennsylvania.

NEW YORK, N. Y. - Circle 7-3326 • PHILADELPHIA, PA. - LOCust 4-0147  
CLEVELAND, OHIO - Superior 1-3242 • DAYTON, OHIO - Michigan 8871  
DETROIT, MICH. - TRinity 4-2060 • CHICAGO, ILL. - Michigan 2-6010  
DALLAS, TEXAS - Riverside 3392 • LOS ANGELES, CAL. - HOLlywood 4-7593  
"In Canada—Railway & Power Engineering Corporation Limited"

**LORD MANUFACTURING COMPANY • ERIE, PA.**



designers  
and producers  
of bonded  
rubber  
products  
since 1924

# TDA<sup>®</sup> BRAKES

*if it moves...we can stop it!*

**equal forward  
and reverse torque output**

Both shoes are applied evenly with equal force and stopping action through a single, straight bore wheel cylinder.

**only 8 different parts,**

exclusive of wheel cylinder, the superior "DH" brake design reduces parts inventory and simplifies maintenance . . . actually 40% fewer parts than most competitive designs.



## **"DH" DUPLEX HYDRAULIC BALANCED BRAKE**

**designed for heavy-duty service**

Greater safety, immediate response, less maintenance and easier servicing are all a part of this rugged new hydraulic brake.

Highly efficient, the "DH" brake is basically a self-energizing two-shoe brake in which both shoes do an equal share of the work . . . and are applied to the brake drum with equal effectiveness in both forward and reverse directions. Floating shoe design eliminates heel and toe clearance problems.

Far simpler, the "DH" brake has actually 40% fewer parts than most competitive designs. This results in smaller parts inventory and easier servicing.

The "DH" brake has already met overwhelming acceptance from many leading manufacturers and

operators. Efficiency and design advantages are winning new uses for the "DH" brake every day.

"DH" Series Hydraulic Brakes are available in a broad range of capacities and sizes . . . to meet a variety of operating needs.

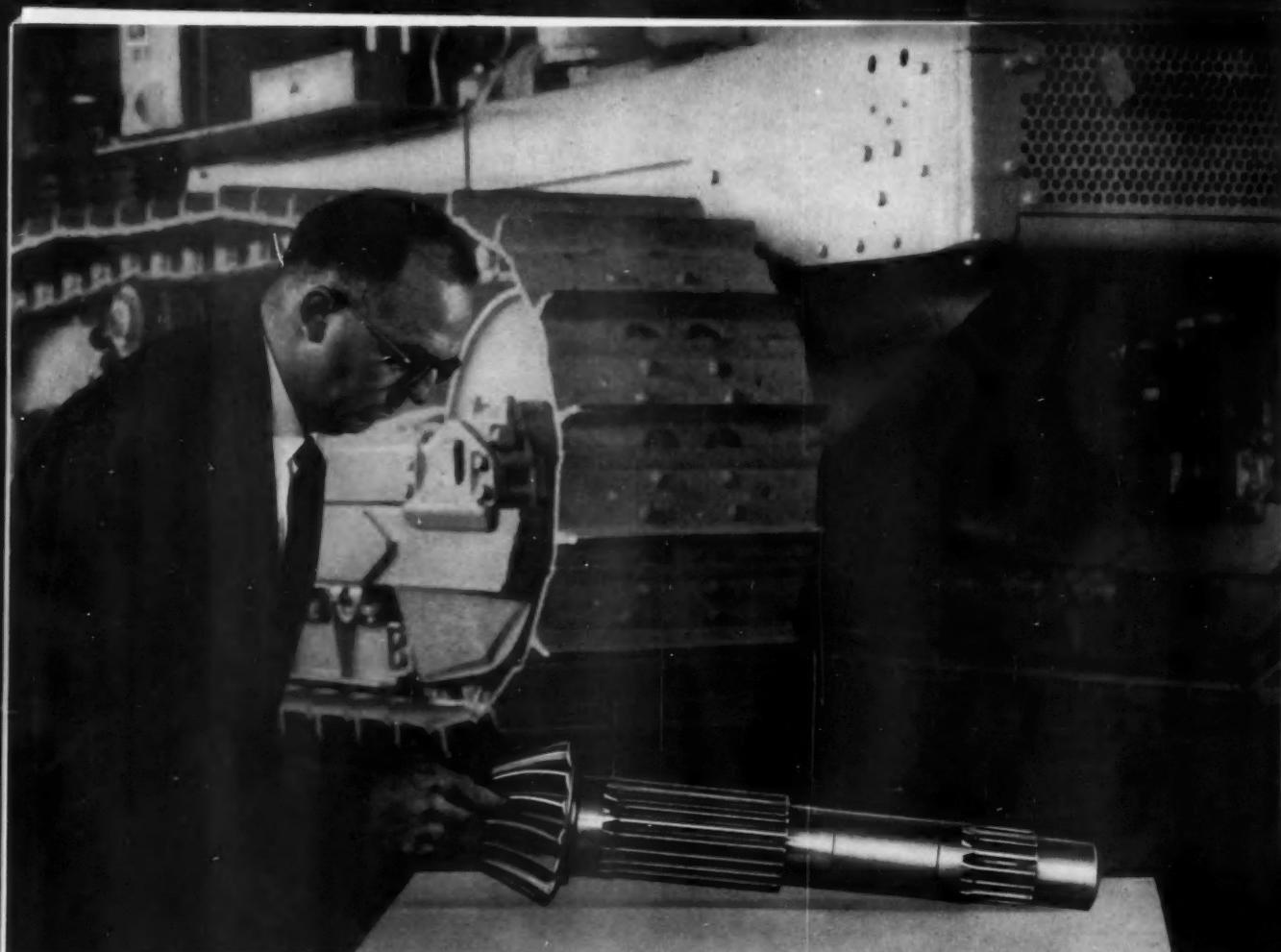
For additional information . . . with expert consultation, contact the Timken-Detroit<sup>®</sup> Brake Division. Complete details and specifications on the "DH" brake are available. A staff of experienced engineers is ready to assist you with any brake problem you may encounter.

©1956 R S & A Company

For every industrial, agricultural or automotive application where braking is required!

Plants at: Detroit, Michigan • Oshkosh, Wisconsin • Utica, New York  
Ashtabula, Kenton and Newark, Ohio • New Castle, Pennsylvania





Caterpillar Tractor Co. Metallurgist T. H. Spencer inspects final drive pinion for D9 crawler tractor weighing 28 tons. Severe loading of this large pinion requires a steel with high case and core hardenability. Several years ago

Caterpillar Tractor Co. found that simply by increasing the molybdenum content of AISI 8622 (to 0.30-0.40%), the desired properties were obtained at lower cost than was possible in any of the standard carburizing grades.

## Caterpillar Tractor Co. improves case and core hardenability of carburizing steel by increasing molybdenum content

"Drive pinions in tractors must take very high torque loads," says T. H. Spencer, Metallurgist for Caterpillar Tractor Co. "AISI 8622 steel, which we had been using, couldn't give us the hard case and strong, tough core we needed in these heavy sections. Other standard carburizing steels with the requisite properties would have cost substantially more. We found, however, that we could achieve the desired surface and core properties by simply modifying AISI 8622 with a higher percentage of molybdenum. We have been using this composition for several years, and results have been excellent."

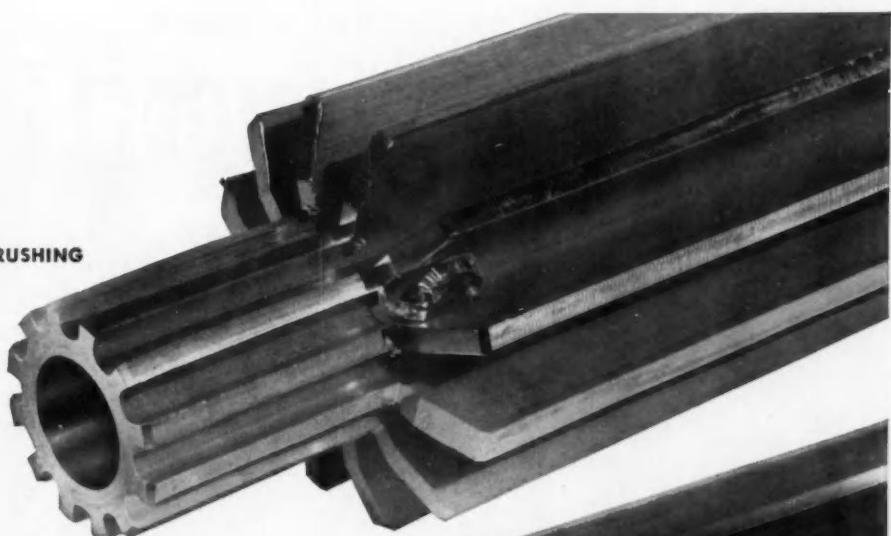
Caterpillar Tractor Co.'s experience shows how increasing molybdenum in a carburizing steel helped to solve a specific problem. Perhaps your product, too, can benefit by higher molybdenum content.

A technical article, "New Carburizing Steels for Critical Gearing", describes some recent investigations of higher-moly carburizing steels. For a reprint, write Climax Molybdenum Company, Dept. 4, 500 Fifth Avenue, New York 36, N. Y.

### CLIMAX MOLYBDENUM



BEFORE BRUSHING



## Quick brush off for burrs

MACHINING this extruded aluminum armature shaft for an aircraft generator turns up heavy burrs. However, Osborn's power brushing method quickly removes burrs and—at the same time—blends all sharp edges.

This is typical of how industry is using Osborn power brushing to improve and speed up thousands of finishing operations.

An Osborn Brushing Analysis made in your plant will show how you can profit from Osborn power brush finishing. Write *The Osborn Manufacturing Company, Dept. E-43, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

# Osborn Brushes



BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES  
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

# the MURRAY WAY MODEL 10 FILTER

**THE AUTOMATIC  
INDUSTRIAL FILTER  
THAT RECLAIMS  
YOUR PRODUCTION  
DOLLARS**



Contaminated coolant enters Model 10 directly from source.

**AUTOMATIC**—The Murray-Way Model 10 Industrial Filter automatically rotates fresh filtering area into position while simultaneously ejecting the contaminant.

**SELF-CLEANING**—The permanent filter screen, made in eight sections and screw mounted, is kept clean by the air knife thus giving maximum filtration at all times.

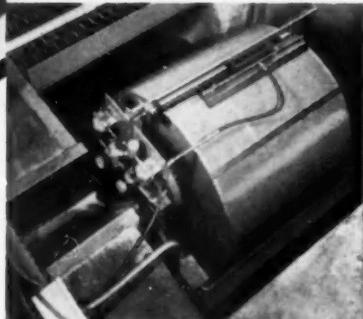
**ECONOMICAL**—Elimination of costly throw-away media saves you money.

**COMPACT**—The Murray-Way Model 10 gives you unusually large filtering capacity in proportion to area occupied.

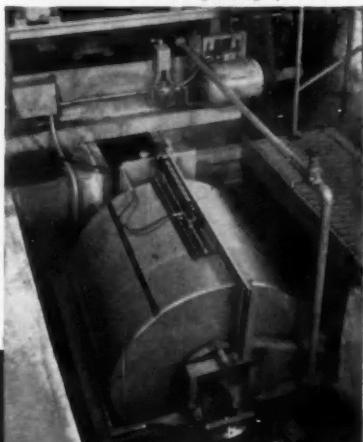
**AMAZINGLY ADAPTABLE**—The Murray-Way Model 10 Filter may be used as an individual machine unit or as a central filtering station for many units. Capacity may be increased by adding filters in tandem separately or in the same tank.

**LARGE SCREEN SELECTION**—We can supply filtering screen material and size of screen opening in monel, stainless steel, brass or bronze to meet your requirements.

For Complete Technical Details—Write For Bulletin F-5301

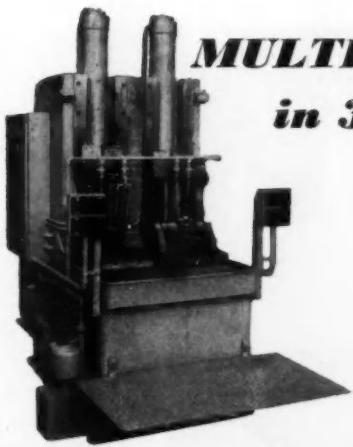


Standard Model 10 with 200 mesh screen removing abrasive grindings from 55 viscous coolant oil in belt grinding operation.



**MURRAY**  
**WAY**

THE MURRAY-WAY CORP.  
POST OFFICE RACK 180 • BIRMINGHAM, MICH.  
Automatic Polishing, Buffing, Grinding, Filtering Equipment



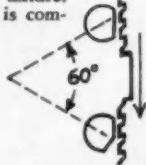
## MULTIPLE SURFACES BROACHED in 3 operations on 1 machine!

American TOOLING IS SIMPLE,  
EFFICIENT, ECONOMICAL

At the first of three stations on this American Dual Ram Broaching Machine, both sides of a pinion mate cross shaft are straddle broached to finished width. Sliding tables automatically move parts into broaching position and return for reloading.

Second station on the left hand ram moves part into position for simultaneous broaching of the sides and bottom of wide center slot and of the two flats on the O.D. of both ends of the shaft.

At the third station, two angular flats are broached on each end of the shaft in a single stroke of the right hand ram. Parts are clamped in a hydraulically actuated, trunnion type, work-holding fixture. As broaching of the first half is completed and a gap in the broaches is reached, fixture tilts automatically to position part for broaching the second flat.



### Production:

OVER 170 PARTS PER HOUR  
AT 100% EFFICIENCY

Here, a standard American broaching machine has been adapted, with relatively inexpensive tooling, to efficient, multiple operations that can be run on automatic or semi-automatic cycle. Versatility of the machine is unimpaired — it can be re-tooled easily for other purposes as later production requirements dictate.

American engineering can accomplish similar things for you. Whether your broaching needs call for relatively low cost tooling or for the highest degree of automation, American can best coordinate the design and building of the right machine, fixtures and broaches.

Write or phone details of your  
requirements. Or write for Catalog 450.

**American BROACH & MACHINE CO.**  
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.  
ANN ARBOR, MICHIGAN

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



When you need them fast,  
Cleveland  
*Top Quality*  
Cap Screws  
reach you by

**Extra Fast  
SERVICE**

It's not enough to make Cleveland Cap Screws "Top Quality" if we can't ship them to you, our customer, when you need them.

Your "due date" to us is more than an impersonal figure on your purchase order—we build our reputation on getting cap screws on their way to you in time to meet your needs.

Our job is to make, stock and sell the widest possible range of sizes in Cap Screws, Set Screws and Milled Studs—ferrous and non-ferrous: bright, high carbon and alloy steel heat treated, brass, silicon bronze, stainless steel. We also produce special hot and cold formed parts to your design and specifications. Standard Cap Screws are made in wide size ranges— $\frac{3}{16}$ " to  $2\frac{1}{2}$ " diameter and in lengths as you require.

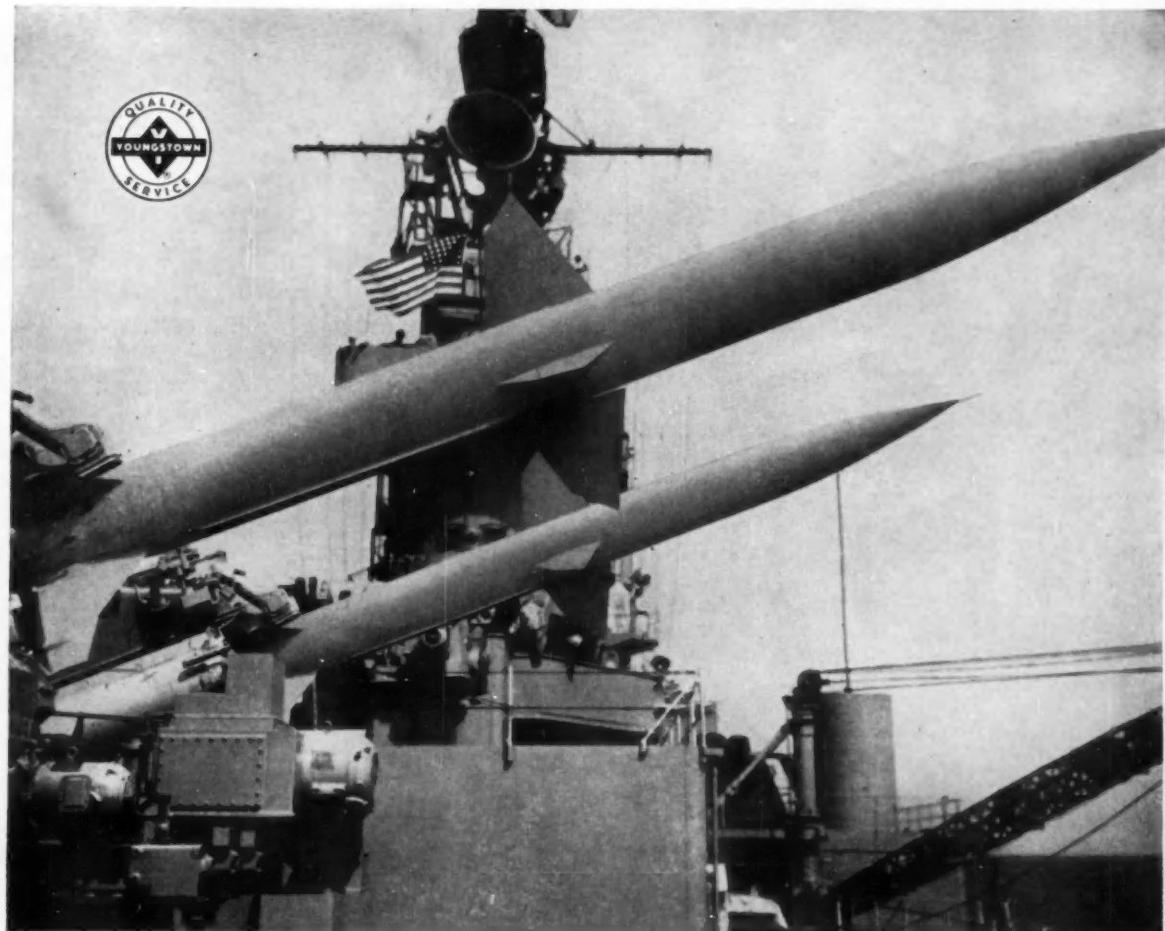
For extra fast service we keep stocks-on-hand of every size and kind we catalog, made by the Kaufman double extrusion Process that assures you extra strength, extra fastenability. Write for latest Stock List!



Efficient stock "filing system" where millions of screws are ready for quick shipment from Cleveland's soon-to-be-occupied new plant.

## The Cleveland Cap Screw Company

2955 East 79th Street • Cleveland 4, Ohio • VULcan 3-3700 TWX CV-42  
Warehouses: Chicago • Philadelphia • New York • Providence • Los Angeles



Official U. S. Navy Photograph

## Supersonic tracker of enemy planes

*Now guarding our coast, U. S. Navy's new guided missile  
has vital parts of Youngstown Alloy Sheets*

Combining metallurgical skills of steelmaking with modern marvels of electronics, Terrier Guided Missiles are capable of destroying hostile targets at long range with great accuracy. The Youngstown Sheet and Tube Company is proud of participating in the production of high

quality steel used in these new weapons for our naval forces. The booster and sustaining mechanism of the Terrier are fabricated of Youngstown Aircraft Quality Alloy Steel Sheets by the Hicks Corporation. Youngstown Alloy Steels are produced in a variety of forms

and qualities to meet customers' specifications. Every ton is subject to a close quality control which insures uniform chemical composition and mechanical properties. Whenever you have requirements for steel, consider Youngstown Carbon Alloy or Yoloy—sheets, bars, plates or pipe.

# Youngstown

THE YOUNGSTOWN SHEET  
AND TUBE COMPANY

*Manufacturers of  
Carbon, Alloy and Yoloy Steel*

General Offices - Youngstown, Ohio  
Export Office-500 Fifth Ave., New York  
District Sales Offices in Principal Cities

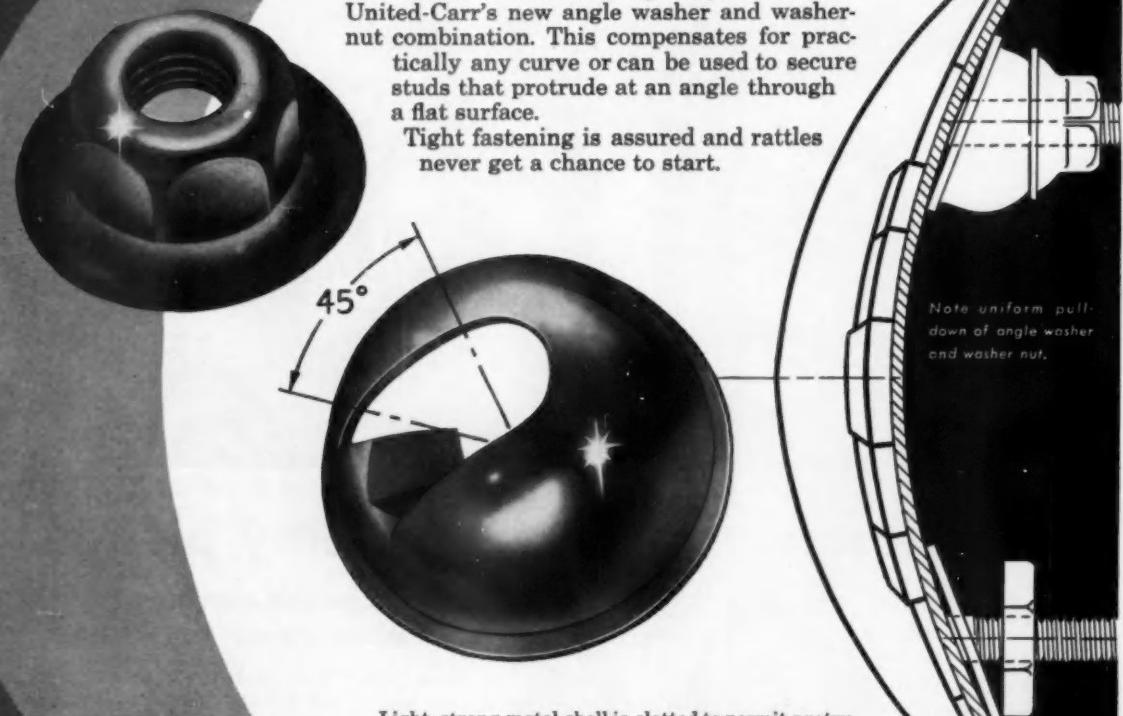
SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT -  
MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - CORE  
TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

# DOT's new angle washer holds cast trim against curves

Fastening die-cast trim to curved sheet metal surfaces can be a troublesome problem. Ordinary nuts jam before they get close enough to hold tight. One solution has been a costly mould construction permitting off-angle stud casting.

The modern cost saving way is to use United-Carr's new angle washer and washer-nut combination. This compensates for practically any curve or can be used to secure studs that protrude at an angle through a flat surface.

Tight fastening is assured and rattles never get a chance to start.



Light, strong metal shell is slotted to permit protrusion of stud at any angle within 45 degree arc. Washer nut matches shape of shell, locks tight with normal wrench torque.

*The angle washer and washer nut are typical of thousands of special-purpose fastening devices designed and manufactured in volume by United-Carr to help speed assembly, cut costs and improve product performance. For further information, consult your nearest United-Carr field representative or write us for his name and address.*

## UNITED-CARR Fastener Corp.

31 Ames Street, Cambridge 42, Mass.

MAKERS OF **DOT** FASTENERS



A battery of six Cecostamps at Canadair, Ltd., ranging from the small 30x24 at the far left, to the big four-column 120x96 shown at the extreme right.

# CECO STAMP

THE STANDARD IMPACT DROP STAMP OF THE AIRCRAFT INDUSTRY

Write for a copy of Bulletin 30-L-5

CHAMBERSBURG ENGINEERING COMPANY • CHAMBERSBURG, PENNA.

*Engineered  
Stampings*



## Do YOU have a stamping problem?

Do you have a difficult part or component that could be produced more economically?

Let Ackermann-Wheeling's staff of design experts and production craftsmen solve your problem... from drawing board to finished

product. Here you will find complete production facilities, ready to mass-produce, assemble and ship, all at one dependable source.

Write, wire or call today for full details on Ackermann-Wheeling's complete service.

## ACKERMANN MANUFACTURING COMPANY

WHEELING, WEST VIRGINIA

STEEL STAMPING DOES IT BETTER....



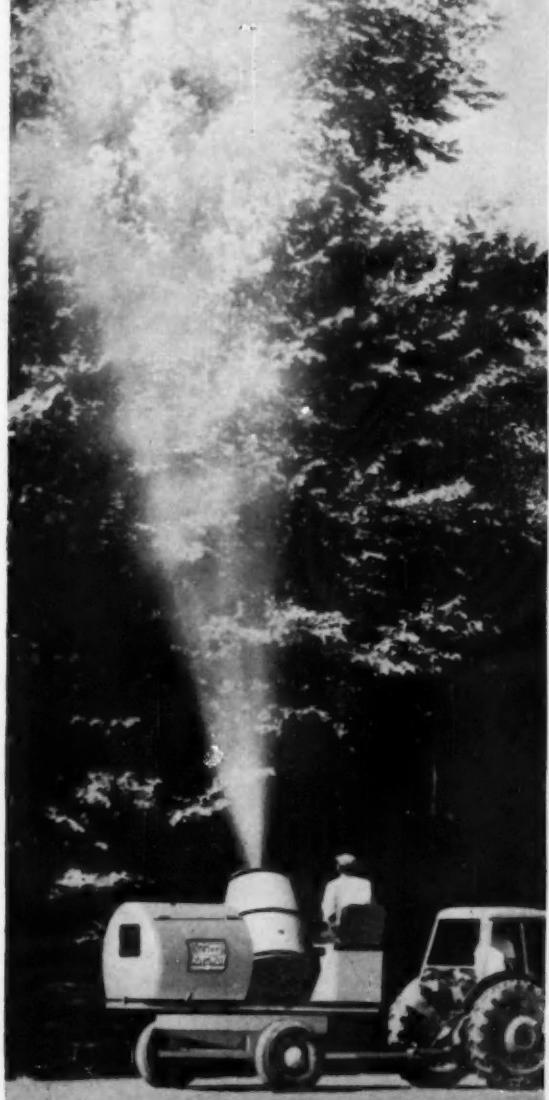
ACKERMANN-WHEELING DOES IT BEST!

### Cut your handling costs with Ackermann **BAND-BOX** Steel Shipping Container

PATENT APPLIED FOR  
It's the ideal solution to in-plant and inter-plant shipping and storing. Rugged, all-steel construction, yet light weight to save on shipping costs. 15 nested boxes occupy cubic area of 1 assembled box. Nestable parts assemble in seconds. Self-palletizing. Engineered to specific requirements. Call, write or wire for full details on the Ackermann Band-Box.



In the  
John Bean "ROTOMIST". . . . . WEBSTER  
Hydraulic Motors  
*for remote power*



- Maximum effectiveness of this John Bean "ROTOMIST" shade tree sprayer depends, in large part, on the instant response of its hydraulically operated turntable. This turntable must be able to rotate 360° in either direction.

To assure maximum speed of response, the hydraulic circuit governing the operation of this turntable is equipped with WEBSTER'S Model MHES Hydraulic Motor.

Whether your particular requirement for a hydraulic pump or motor is speed of response, shock resistance, dependable performance, or compactness for installation in a crowded area, WEBSTER has the answer. And WEBSTER gives you the widest possible selection—over 100 models of gear-type pumps ranging in capacities from 1/5 to 30 gpm, for pressures up to 1500 psi and speeds to 3600 rpm, and hydraulic motors up to 20 hp at 2000 rpm.

Their quality construction features and moderate price make a combination which will pleasantly surprise you.

OIL HYDRAULICS DIVISION  
**WEBSTER**  **ELECTRIC**  
RACINE WISCONSIN

**FREE 12-PAGE CATALOG**  
contains complete information on  
WEBSTER'S complete line of over 100  
different positive displacement  
gear-type pumps and fluid motors.  
Write for your free copy today.



WEBSTER ELECTRIC COMPANY  
Racine, Wisconsin

Please forward a copy of Bulletin H3A1.

Name \_\_\_\_\_  
Title \_\_\_\_\_  
Company \_\_\_\_\_  
Street \_\_\_\_\_  
City, Zone & State \_\_\_\_\_



MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS FROM 1/5 TO 30 GPM CAPACITY

\*

Quantity  
PRODUCTION  
of  
GREY IRON CASTINGS

\*

ONE OF THE NATION'S  
LARGEST AND MOST MODERN  
PRODUCTION FOUNDRIES

\*

ESTABLISHED 1866  
**THE WHELAND COMPANY**  
FOUNDRY DIVISION

MAIN OFFICE AND MANUFACTURING PLANTS  
**CHATTANOOGA 2, TENNESSEE**

**PROVEN**

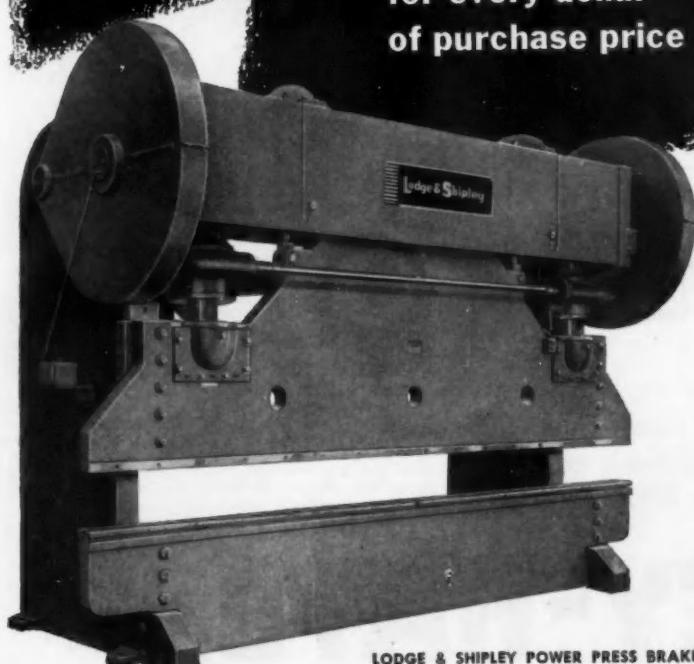
**DESIGN**

**PLUS**

**LODGE & SHIPLEY**

**"KNOW HOW"**

**gives you  
a better brake  
for every dollar  
of purchase price**



**LODGE & SHIPLEY POWER PRESS BRAKE**  
Series 350 Capacities from 8' x 5/8" to 20' x 1/4"

From a background of more than 100 years of experience in building heavy metalworking equipment, Lodge & Shipley is producing power press brakes equal or superior to any other.

Built to Lodge & Shipley standards of strength and accuracy, for long service and minimum maintenance, these power press brakes offer many features which contribute to cost savings.

For example, the air clutch and spring brake is specifically designed for press brake service. The smoothly operating positive clutch is installed in a heavy, balanced flywheel. When the clutch is disengaged, the disc-type friction brake is automatically applied, positively holds the ram in any position.

Give yourself a *better brake*, check the many features of Lodge & Shipley power press brakes against any other power press brake . . . then make your decision.

Write for **FREE Bulletin PB-4** and the name of your nearest distributor.

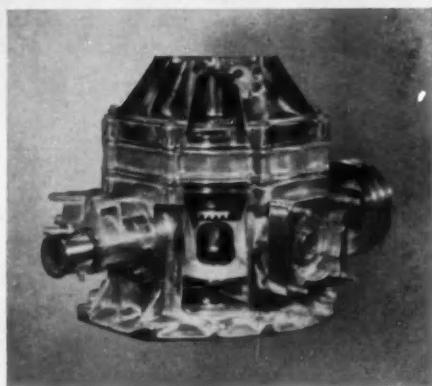
THE **Lodge & Shipley**  
COMPANY  
3071 Colerain Ave., Cincinnati 25, Ohio



*Crop destroying pests—gone with the whirlwind.*

## Kelsey-Hayes helps Bell put whirlwind power in the 47-G

1,800,000 cu. ft. of air per minute! That's the amazing downwash of the Bell 47-G Helicopter. Power to propel this versatile rotorcraft flows smoothly through a precision-gearred transmission produced for Bell by SPECO, the Steel Products Engineering Division of Kelsey-Hayes. For over 40 years, the manufacture of precision gears and gear assemblies for aircraft has been a SPECO specialty.



*Bell 47-G transmission* is one of over 100 parts produced by Kelsey-Hayes for the 47-G helicopter. Other products for the aviation field include accessory gear assemblies, actuators, computers, controls, bomb hoists, gun turrets, radar tracking and scanning assemblies, power recovery units, compressor rotors and turbine sections, blades, buckets, vanes.

# KELSEY-HAYES

**Kelsey-Hayes Wheel Co., Detroit 32, Mich. • Major Supplier to the Automotive, Aviation and Agricultural Industries**  
**TEN PLANTS / Detroit and Jackson, Michigan; McKeesport, Pa.; Los Angeles, Calif.; Windsor, Ontario, Canada • Davenport, Iowa**  
 (French & Hecht Farm Implement and Wheel Division) • Springfield, Ohio (SPECO Aviation, Electronics and Machine Tool Division)

This is the sixteenth of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

## Copper: Its Principal Effects in Alloy Steels

One of the best known of all metals, copper certainly needs no introduction here. Its uses are legion. It is one of the best conductors of heat and electricity. It is popular with the housewife, essential to the engineer. But possibly not so well known is its very important function as an alloying element in certain types of steels. So used, copper increases resistance to atmospheric corrosion and also acts as a strengthening agent.

Since copper does not oxidize in the steel melt, it can be added at any time during the course of the heat. Pure copper melts at about 1980 deg F.

Copper is added to steel in varying amounts. The actual proportion, of course, depends upon the end product in mind. Some of the most widely used copper-bearing steels are those containing from 0.20 to 0.50 pct. In these, copper has been found to increase corrosion-resistance without materially affecting mechanical properties. It has been found, too, that paint frequently lasts longer on such steels than on the non-copper-bearing types.

Among the best known of the copper-bearing steels are the high-strength, low-alloy grades developed in recent years. Generally speaking, the ductility of steels in this group is comparable to that of conven-

tional structural steel. The yield strength, however, is usually higher. Copper, working as a team with chromium, nickel, and phosphorus, substantially raises the level of corrosion-resistance in these steels; yet its presence does not adversely affect welding characteristics.

Copper-bearing steels are a subject in themselves, a subject in which Bethlehem metallurgists are well versed. If you would care to know more about this interesting group of steels, feel free to consult with our technicians. They will gladly work closely with you and help with any problems you may encounter. And please remember, too, when you need alloy steels of any kind, that Bethlehem manufactures the full range of AISI standard alloy grades, as well as special-analysis steels and all carbon grades.

If you would like reprints of this entire series of advertisements, Nos. I through XVI, please write to us, addressing your request to Publications Dept., Bethlehem Steel Company, Bethlehem, Pa. The material is now available in a convenient 32-page booklet, and we shall be very glad to send you a free copy.

BETHLEHEM STEEL COMPANY  
BETHLEHEM, PA.

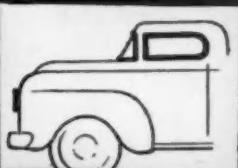
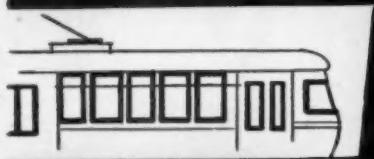
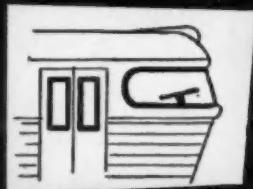
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation, Export Distributor; Bethlehem Steel Export Corporation



**BETHLEHEM STEEL**

# DESIGN VERSATILITY

with Inland Self-Sealing Weather Strip



Whether your sealing problem is glass or plastic, flat or curved, air or water pressure, fixed window or sliding window, single or double pane, Inland Strip will not leak. Panels will remain tight, with rattling and vibration eliminated and visibility unimpaired. Then too, original installation costs will be reduced and replacing broken panels will be a fast, one-man, low-cost job.

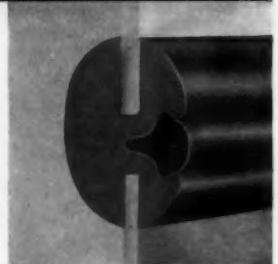
Inland's Self-Sealing Weather Strip is available in numerous standard shapes and sizes. Tailor-made Inland Strips can be produced to meet individual requirements. Whether it's standard or of a special design, Inland Strip will give you perfect results . . . results achieved by Inland's patented Filler Strip, . . . an exclusive, basically simple and correct installation principle!

Whether you design, specify or install Inland Strip, you're assured of a product made to precise dimensions and specifications assuring a long trouble-free service life.

## INLAND *self-sealing weather strip*



INLAND MANUFACTURING DIVISION  
General Motors Corporation, Dayton, Ohio



a part of the General Motors Master Plan for Greater Highway Safety through Better Engineered Products!

Whatever  
the DESIGN . . .

We can make it  
**WATER-TIGHT!**



Transportation Industry



Automotive Installations



Railway Equipment



Marine Applications

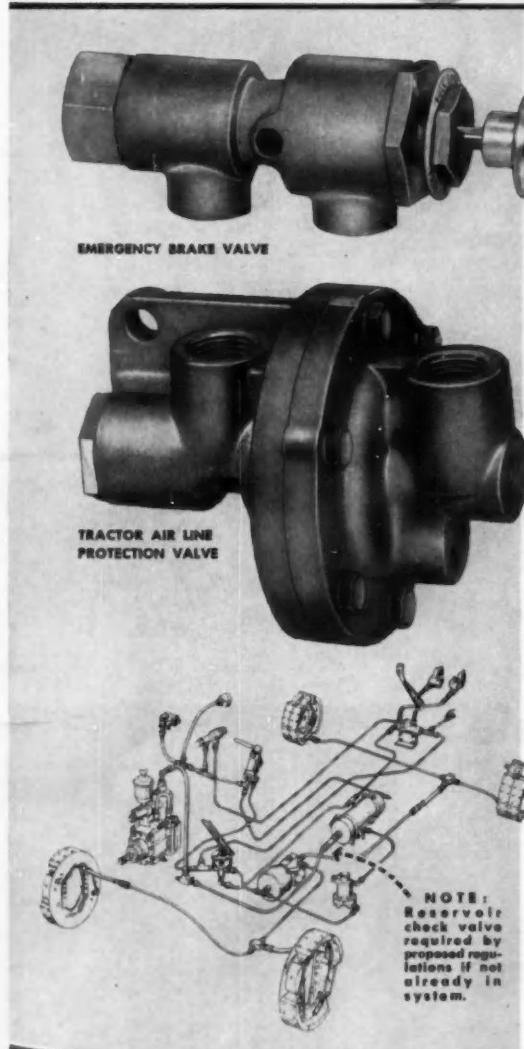


Over-the-road Equipment



Commercial Structures

# Now... you can give tractors both **MANUAL and FULLY AUTOMATIC protection!**



**Wagner's two new tractor valves in combination with ANY trailer emergency (breakaway) valve protect tractor-trailers —meet all new I. C. C. regulations!**

The emergency brake valve triggers emergency braking on the trailer and may be operated manually, at any time, or will automatically operate when air loss drops pressure to a pre-determined value.

The towing vehicle is protected by the tractor airline protection valve which automatically isolates the tractor air supply and provides normal brake control of the tractor in the event of a pressure loss on the trailer.

## These Two New Valves Provide these Superior Advantages

### Manual and fully automatic protection

Emergency braking may be triggered at any time by merely pulling the valve knob; however, the fully automatic application requires no special thought or action on the part of the driver in any emergency due to trailer breakaway or air loss failure.

### Compatible with all makes of trailer equipment

Trailers equipped with air brakes of popular manufacture may be freely interchanged.

### Tested automatically

Valves are automatically and completely tested each time a trailer is coupled and uncoupled.

### Simplifies the driver's job

No need to climb on tractor to open or close shut-off cocks. All driver does after making "glad-hand" hose connections is to depress the emergency brake knob, completely charging the trailer air brake system. Contact your local Wagner Air Brake Representative—or write for Bulletin KU-281.

### Choice of Three Installation Kits

For installing new tractor air brake system:

Kit No. A23348—

includes reservoir check valve

Kit No. A23349—

without reservoir check valve

For converting tractor air brake system:

Kit No. A23351—

includes check valve

Kit No. A23352—

without check valve

For modifying systems

presently equipped with Wagner tractor protection valves

Kit No. A23367—

includes check valve

Kit No. A23368—

without check valve

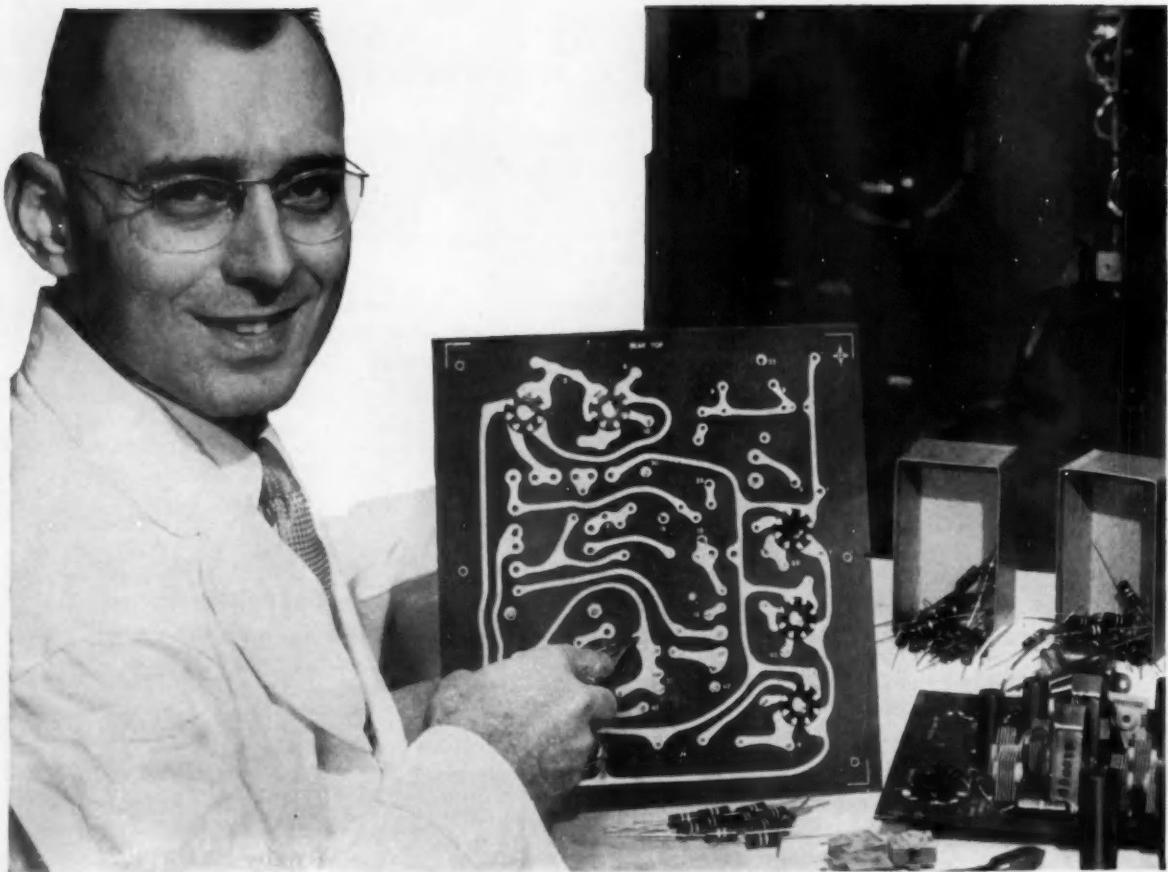
**NOTE:**  
Reservoir  
check valve  
required by  
proposed regu-  
lations if not  
already in  
system.

## Wagner Air Brake Systems

Wagner Electric Corporation 6363 Plymouth Ave.  
ST. LOUIS 14, MISSOURI

K56-8B

LOCKHEED HYDRAULIC BRAKE PARTS and FLUID • NeRo • CoMoX BRAKE LINING • AIR BRAKES • AIR HORNS • TACHOGRAPH • ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES



## **Keeps production profitable**

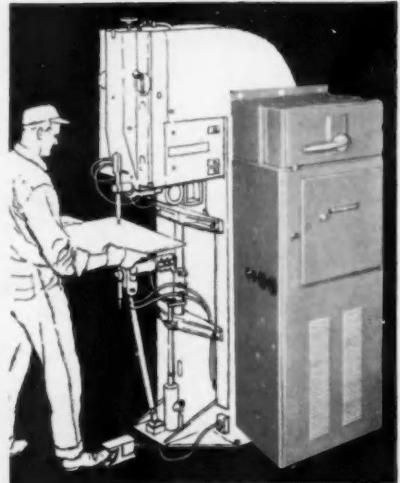
### **The Westinghouse Weld-O-Timer . . . with printed circuits**

Dependable printed circuits assure uninterrupted production in the new Westinghouse Weld-O-Timer\*. These efficient circuits make scrambled wiring a thing of the past. The clearly marked panel—identifying each component by type, rating, and location—and the elimination of 27 feet of wire make maintenance and inspection fast and easy.

This means high production welding and dependability from industry's most advanced resistance welding control, now 30 percent lighter in weight than the old design.

For all the facts, call your Westinghouse sales engineer. Or write Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Penna.

J-21936

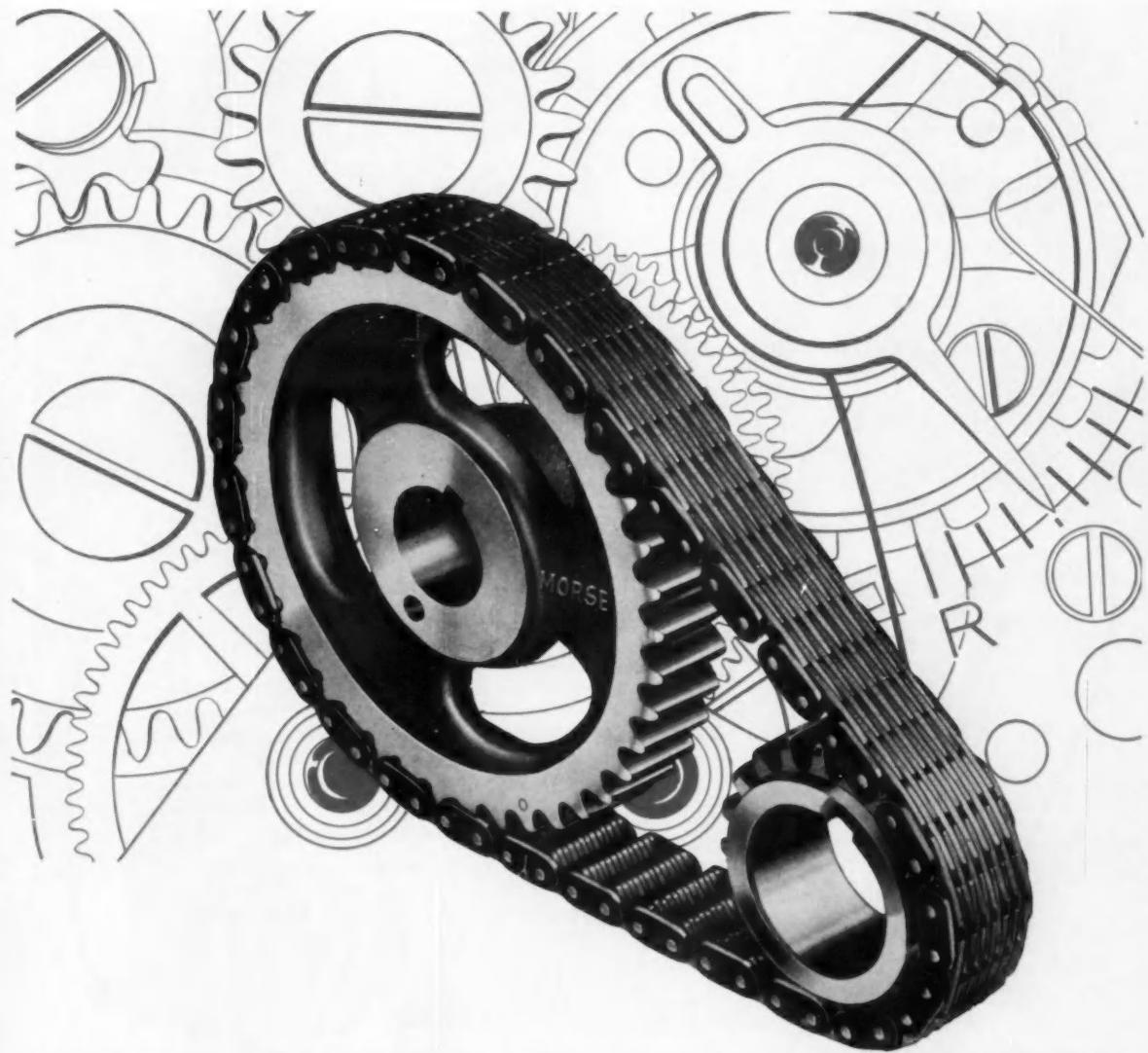


Everything about this new resistance welding control is designed for high production, product and personnel protection and longer lived dependability.

\*Trade-Mark

**WATCH WESTINGHOUSE!**

WHERE BIG THINGS ARE HAPPENING TODAY!



## Morse Automotive Timing Chain —built with fine-watch precision

Precision manufacture is your guarantee that Morse Timing Chain—like a fine watch—will give years of dependable, trouble-free service.

Years ago, periodic replacement of timing chains was expected by every auto owner. Today, Morse Timing Chains, specified on 18 out of the 22 automobiles made in America, are expected to last for the life of the automobile.

Life expectancy of timing chains has increased, thanks to Morse's rigid quality controls, auto-

matic precision assembly machines, and advanced inspection equipment.

Check first with Morse on timing chain problems. Find out, too, how well other Morse products can answer your needs in power transmission design and application.

Morse Chain Company,  
A Borg-Warner Industry—  
Ithaca, N.Y.—Detroit, Mich.

# MORSE

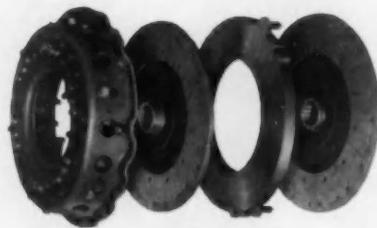


POWER TRANSMISSION  
PRODUCTS

® trademark

New equipment, expanded departments, added technical personnel and increased productivity all help to make Long your ideal "production partner."

But you'll discover Long's real plus factors in our management-engineering team. Its talent for creating high quality products with economical design and volume manufacturing advantages is your biggest profit potential.



#### DOUBLE-PLATE CLUTCHES BOOST TORQUE CAPACITY

Available in many sizes, Long's double-plate clutches with high-gripping action anticipate advancing horsepower and torque requirements in trucks, tractors, off-highway vehicles and industrial applications. Like Long single-plate clutches, these heavy-duty production models are individually tailored by our engineers to performance requirements of any size or type of vehicle.

Long-innovated clutch features that have set industry standards include dry discs, variable springing, high-ventilation triangular covers, spring vibration dampers and cushion segments. Ask us to recommend an application conforming to your specifications.



**LONG MANUFACTURING DIVISION, BORG-WARNER CORPORATION**

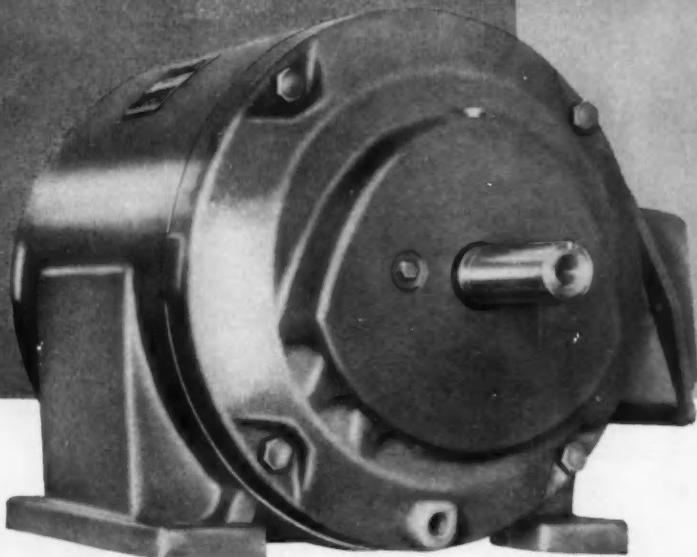
12501 DeQuindre Street, Detroit 12, Michigan

Also: Oakville, Ontario, Canada

Export Sales: Borg-Warner International, 36 South Wabash St., Chicago 3, Illinois

THE STANDARD OF QUALITY AND PERFORMANCE SINCE 1903

# Totally Protected



FROM  
CORE  
TO  
COVER

RELIANCE  
Totally Protected  
MOTORS

The total protection concept of design and construction armors Reliance A-c. Motors against everyday hazards, with little or no maintenance. Total protection is made up of extra features like:

- Slot cell insulation of Double Backed Mylar
- Dynamically balanced rotor for vibrationless operation
- Entire insulation system impervious to acids, moisture and oils
- Metering plate regulates grease flow to bearing
- Ventilation louvres positioned high and dry in end brackets

There are 100 of these extra core to cover protection features in Reliance Motors. Each point is covered in our bulletin, "Check the Facts". Why don't you write for one and get all the details.

B1510

**RELIANCE** ELECTRIC AND  
ENGINEERING CO.

DEPT. 57A, CLEVELAND 10, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO  
Sales Offices and Distributors in Principal Cities

*Oldest in age  
Still in  
the lead*

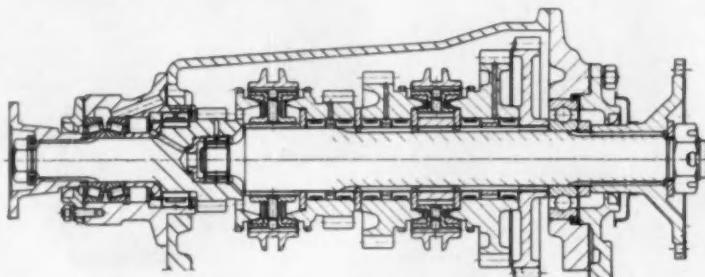
loose needles



needle cartridges



complete bearings



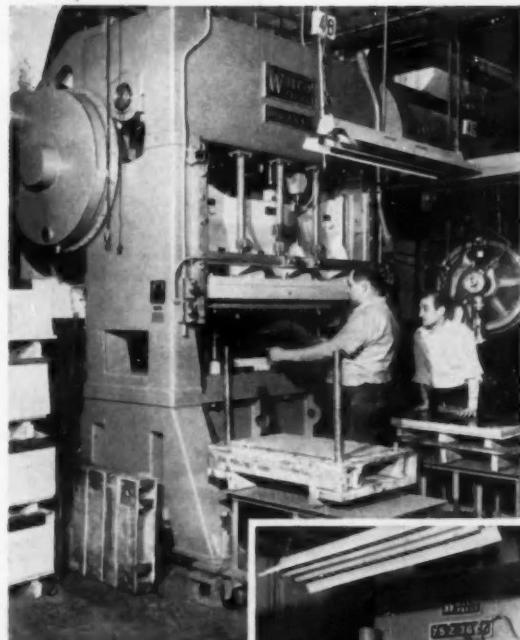
GEAR BOX FOR TRUCKS



**NADELLA**  
NEEDLE BEARINGS

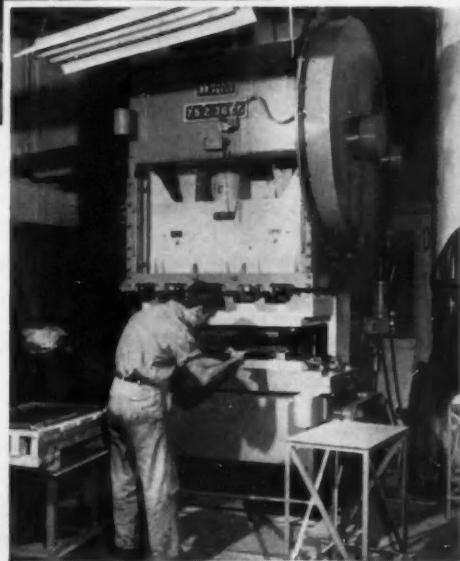
ACTA

133 à 137 BOUL. NATIONAL - RUEIL-MALMAISON (S.-&-O.) FRANCE



Press Foreman Andrew Harris watches as press operator Andrew Amodeo operates 100-ton Warco Crank Press.

Salvatore Cordero puts flanges on stamping with Warco 75-ton Crank Gap Press.



**federal**  
WELDERS

**Warco**  
PRESSES

The Federal Machine and Welder Company

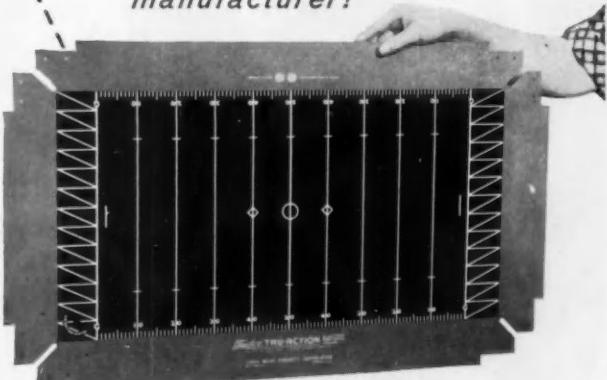
WARREN, OHIO



The highly popular Tudor Tru-Action Electric Football Game. Tudor also makes electric baseball and horse racing games.

# "Warco's a winner!"

says leading metal game manufacturer!



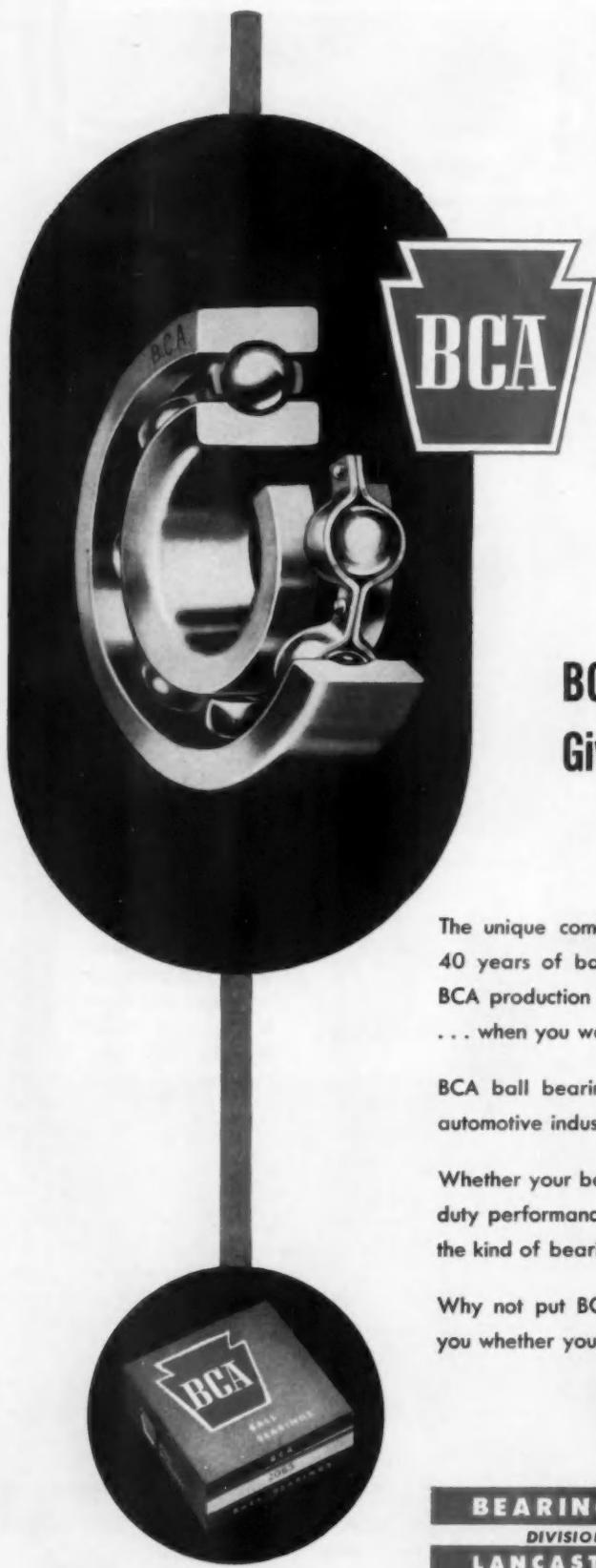
Typical game stamping. Presswork must be accurate, clean and not disturb lithography.



"We've tried quite a number of different presses in our shop—and in our books, Warco is a winner," say officials of the Tudor Metals Products Corporation of Brooklyn, N. Y., one of the nation's leading manufacturers of metal games.

"Clean and neat of design, they perform with businesslike efficiency, with a minimum of maintenance. We like what we have seen, and certainly must give them an inside track when considering new press equipment."

If you haven't as yet talked with a Warco user, why not let us put you in touch with one in your area. We know he'll convince you that Warco will win for you, too.



## BCA Experience and Flexibility Give You The Bearings You Want ... when you want them

The unique combination of BCA experience—based on more than 40 years of ball bearing design and manufacture—and versatile BCA production facilities assure you the kind of bearings you want . . . when you want them.

BCA ball bearings are widely used as original equipment in the automotive industry and in other fields.

Whether your ball bearing applications call for high speed or heavy duty performance—or a combination of both—BCA can supply you the kind of bearings that will give you superior product performance.

Why not put BCA experience, personnel and facilities to work for you whether your bearings needs are routine or unusual?

**ENGINEERS:** Send for a copy of BCA's valuable 100-page handbook. It's free. Write on your company letterhead.

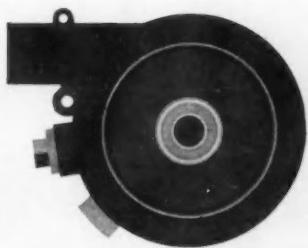
**BEARINGS COMPANY OF AMERICA**

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC.

LANCASTER • PENNSYLVANIA

# DO YOU USE FABRICATED METAL PARTS? .. VOLUME GOING UP?

.. this chart shows how Richardson molded parts can reduce production costs (example: a water pump housing):



Year	Production Method	Total Annual Quantity	Total Cost	Unit Cost
1st year	fabricated metal	3,600 pump housings	labor and material \$7,200.00	\$2.00
2nd year	molded plastics	now increased to 12,000 pump housings	plastic mold ..... \$8,000.00 12,000 housings purchased from Richardson ..... 9,000.00 <hr/> \$17,000.00	\$1.42
3rd year	molded plastics	same quantity—12,000 pump housings	mold (charged off on previous year's production—still good for hundreds-of-thousands of parts) ..... 12,000 housings purchased from Richardson ..... \$9,000.00 <hr/> \$9,000.00	only 75c

## Molded parts also offer these advantages:

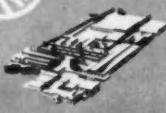
- .. smooth, attractive surface!
- .. no painting necessary—plastic is rustproof!
- .. save assembly time—inserts mold in!
- .. plastic reduces noise and insulates against heat!

Richardson engineers are available to assist you in determining molding costs. Working with your own engineers, they can cooperate in the development of new designs for improved performance, better appearance, and reduced production costs.. experienced tool and diemakers, working in one of industry's largest tool and die shops, can produce long-lasting molds accurately. Write or phone today—Chicago, MAnfield 6-8900. The Richardson Company, 2678 Lake St., Melrose Park, Illinois (Chicago area).



## RICHARDSON PLASTICS

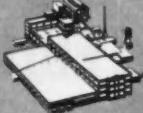
MOLDED AND LAMINATED



MELROSE PARK,  
ILL.



INDIANAPOLIS,  
IND.



NEW BRUNSWICK,  
N.J.



NEWNAN,  
GA.



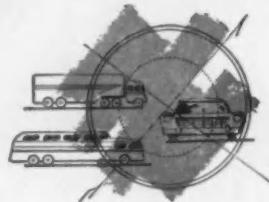
OGDEN,  
UTAH



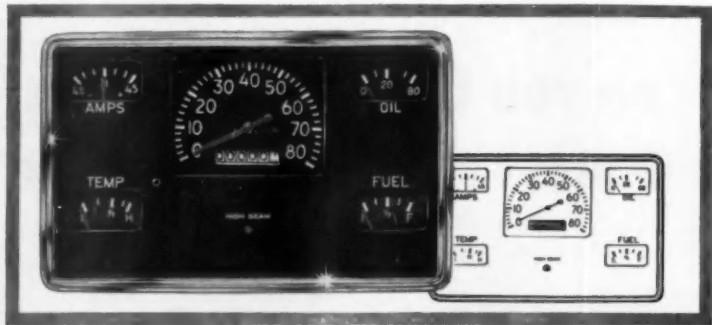
TYLER,  
TEXAS

**How  
STEWART-  
WARNER**

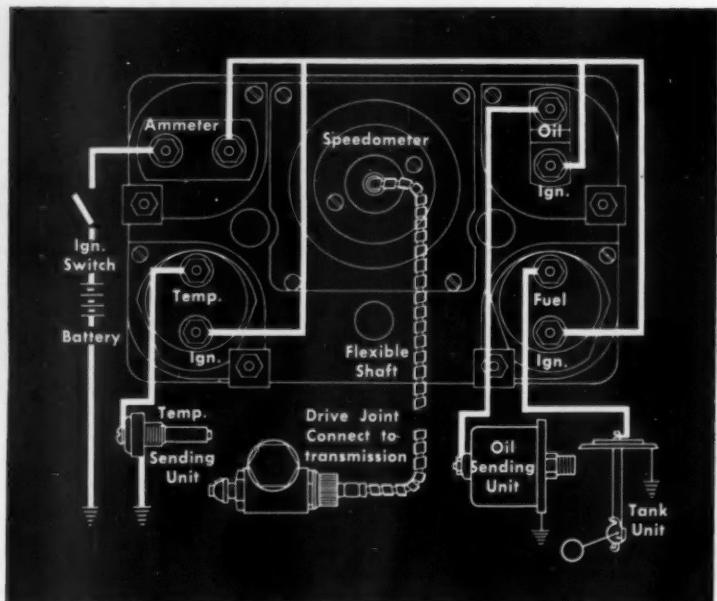
*can help you plan  
a complete  
**INSTRUMENT  
PANEL***



**...from designs  
to finished panels  
...custom-made  
or stock models  
—for cars,  
trucks, buses  
and engines!**



**Stewart-Warner Panel 602-H.** A stock panel now used by leading truck manufacturers. Highly flexible—can be fully electric or combination of electric and mechanical.



**Typical Hook-up for Panel 602-H.** Above panel includes mechanical speedometer, electric gauges, complete with sending units.

**At every step of design**—from styling of panel to choosing drive equipment—Stewart-Warner offers you the widest selection . . . plus engineering teamwork unmatched by any other manufacturer!

Stewart-Warner furnishes the most complete line of individual instruments—speedometers, tachometers, tachourmeters—and gauges of all types. Our engineers will help you combine these in one of our

many standard panels . . . or an entire panel can be custom-made to your specifications.

Stewart-Warner—instrument specialists for over half a century—can supply all your instrument needs and drive equipment from one dependable manufacturing source. Save money by consulting Stewart-Warner now . . . while your designs are still in the early planning stage and are subject to modification!

*For further information, write:*

# STEWART-WARNER

STEWART  
SW  
WARNER

Dept. T-76, Original Equipment Sales  
1826 Diversey Parkway • Chicago 14, Illinois

*Do your present truck heaters have a ----,*

**EVANS**  
custom-designed  
truck heaters  
have it!



Your Evans Truck Heaters *have* to be good! To prove it, Evans backs every single heater they build with a full year—or 50,000 mile—warranty (whichever occurs first). This is your assurance—and your *customers'* too—that Evans Heaters are the *right* heaters for the trucks you build.

What's more, the heaters Evans engineers design and custom-build for you will meet *all* your truck requirements. They will fit *right*—for quick, easy installation. They will deliver all the BTU's needed for maximum driver safety and comfort—under *any* weather conditions. And special, heavy-duty construction means that the owner gets longer service with much less maintenance.

There's an Evans Heater for *every* type commercial vehicle, from local panel delivery truck to giant over-the-road haulers. Why not let Evans solve your truck heating problems, whatever they may be?

**REGIONAL REPRESENTATIVES:**

Cleveland, Frank A. Chase • Chicago, R. A. Lennox Co., Inc. • Detroit, Chas. F. Murray Sales Co. • Allentown, Pa., P. R. Weidner.

**PARTS**

"Repair or  
Replace"

**WARRANTY**

good  
for one year  
or

5 0 0 0 0

miles?



**EVANS PRODUCTS COMPANY**

also produces: *Eranite battery separators; railroad loading equipment; bicycles and velocipedes; and Evaneer fir plywood*

# Insist on VELLUMOID!

VELLOMOID



DRY VELLUMOID

THE VELLUMOID COMPANY • Worcester, Mass.

## The FIRST Name in Gaskets

There is no substitute for quality. Use Vellumoid for all oil, water and gasoline connections.

### Handiest Locations in PITTSBURGH

*Hotel Pittsburgher*

PITTSBURGH, PA.

Diamond Street below Grant



Right in the heart of the Golden Triangle—Hotel Pittsburgher

400 outside rooms with bath. Large-screen television and radio at no extra charge in every room. Air conditioning. Two restaurants. *Atlantic* 1-6970

Hotel Pittsburgher MOTEL

Opposite Greater Pittsburgh Airport on Airport Parkway west. 56 air-conditioned rooms with large-screen television at no extra charge, tile bath, private phone. Courtesy car to and from motel.  
AMherst 4-5152

a Knott Hotel

JOSEPH F. DUDDY, GEN. MGR.

## OPERATE HORIZONTAL MILLING MACHINES?

### FREE DETAILS

illustrate how you can increase horizontal milling machine feeds and speeds up to 200%. Jergens tapered roller bearing bushing replaces present bronze bushing at low cost without machine change. Eliminates bushing wear, cutter breakage, arbor wear, scoring and chatter. Permits use of carbide cutters to full capacity on new or old machines. Write for cost cutting facts today!



**DONLEY PRODUCTS, INC.**  
Dept. AI-7, 11104 AVON AVE., CLEVELAND, OHIO

### New RAILS Relaying



TRACKWORK of ALL KINDS  
LIGHT RAILS—12# TO 60#—20' 0" & 30'  
HEAVY RAILS—40# TO 100#—30' 0" & 33'  
JOINT BARS, BOLTS, TIE PLATES, SPIKES &  
TOOLS, FROGS, SWITCHES, STANDARD &  
SPECIAL TRACKWORK.

SEND US YOUR INQUIRIES

**KASLE STEEL CORPORATION**  
Box 120 Roosevelt Park Annex, Detroit 22, Mich.—Phone Tafford 6-4600

## AUTOMOTIVE INDUSTRIES

Penetrates into Leading Plants  
in the

Automotive and Aircraft Industries

Now Available in  
"SPRAY ON" CANS and in "BULK"  
**CROWN design layout ink**

Order it the way you use it most—in handy Aerosol spray can or in pints, quarts, gallons or barrels in bulk. No waste, no mess, no stained hands—Crown ink dries to an excellent scribbling texture in a minute. Also ideal for "OK" or "reject" inspection marking.

\$159 per 12 oz. can  
only

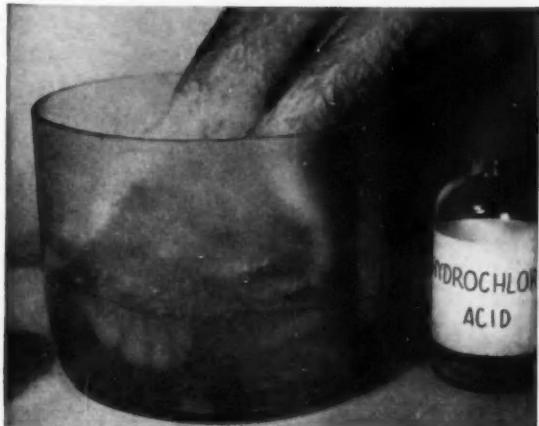
Just Press the Trigger on the Can

Order from distributor or mail coupon

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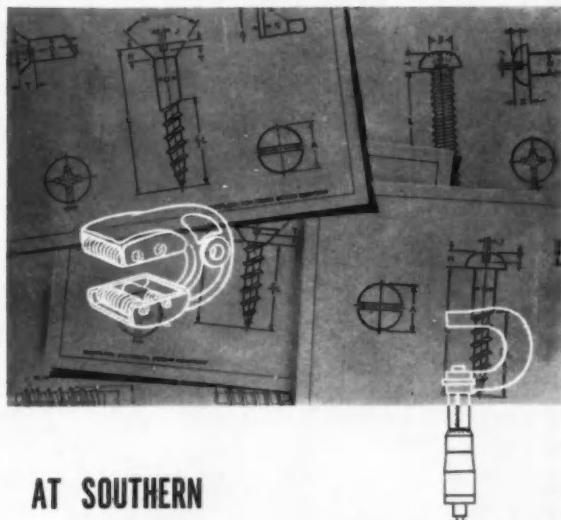
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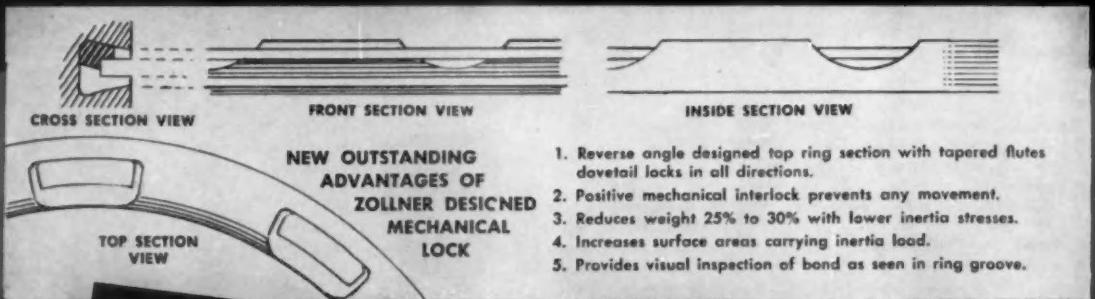
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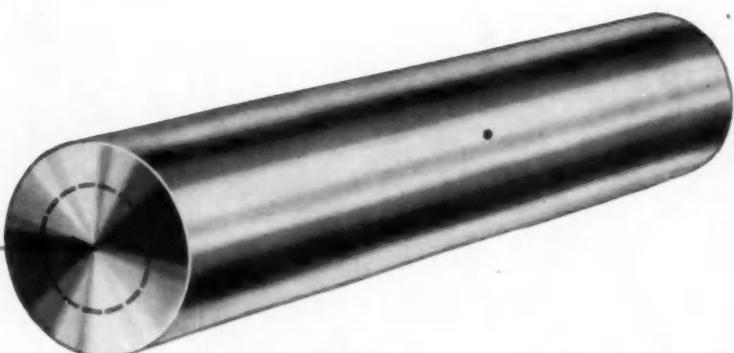
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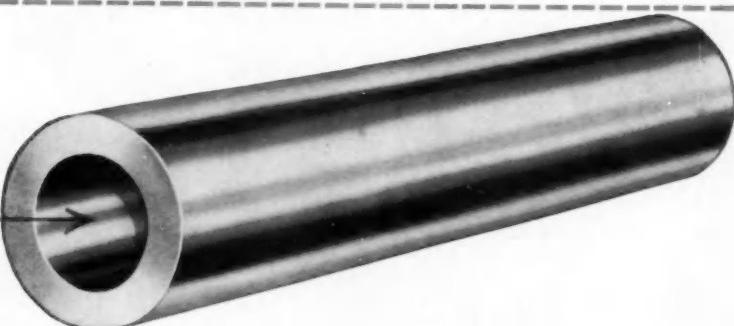


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